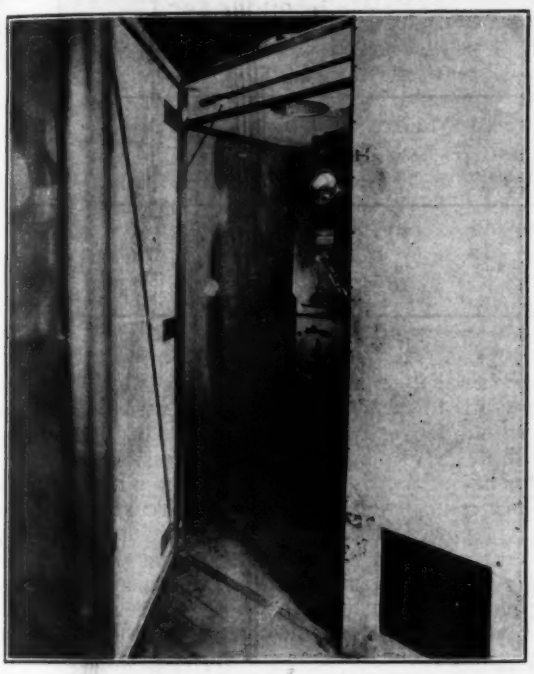
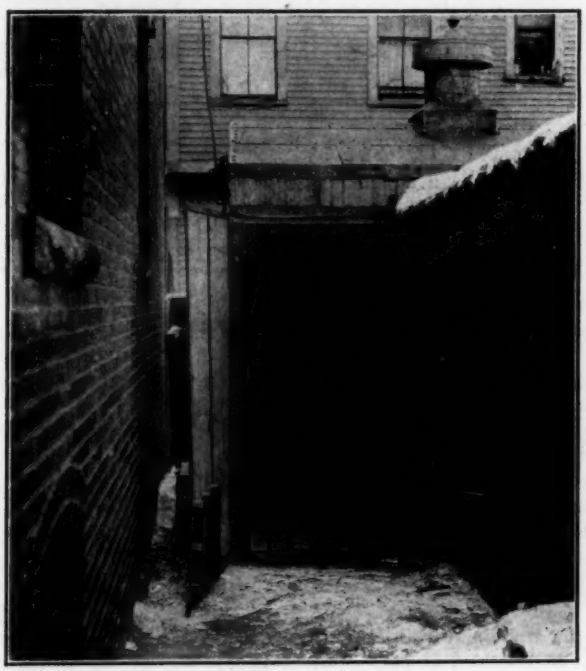
Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

Vol. 73—No. 9. CHICAGO, SATURDAY, AUGUST 31, 1918. Page 317.



Asbestos Room Housing 100-kva. Static Condenser.



Galvanized Iron House for 100-kva. Condenser.

Improving Power-Factor by Static Condenser

Importance of High Power-Factor Emphasized—Application and Sphere of the Static Condenser—Concrete Examples and Instances of Its Use

THE economical operation of a generating system is dependent on the maintenance of a relatively high power-factor. The reduction in the output of generators, transformers and distributing feeders, as well as the increase in heating losses and impaired voltage regulation resulting from low power-factor loads, are well recognized by central stations. In many cases on large generating systems the increment of load has warranted the installation of a synchronous condenser in the generating station, in the substation, or, if an attendant is available, at the point of application, to overcome the detrimental effects of the low power-factor conditions. In order to meet the demand for a condenser which would provide similar corrections for comparatively small loads having low power-factor, and which would not require an attendant, the static condenser for power-factor improvement has been developed.

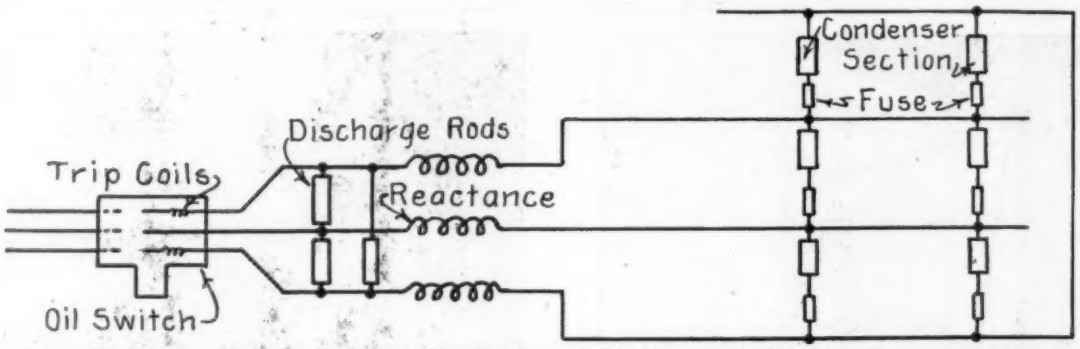
The static condenser as used for power-factor improvement consists of a number of condensers mounted closely together to form a compact "unit" and the control apparatus for the entire unit. Each condenser, as designed by the General Electric Company in the United States and by other companies in Europe, is composed of paper and metal foil submerged in oil and assembled in metal containers.

The accompanying is a schematic wiring diagram of a three-phase installation of static condensers as designed by the General Electric Company. If a condenser is connected directly across the line it will generally be found that instead of raising the power-factor it lowers it because a condenser tends to accentuate the harmonics in the voltage wave so as to interfere with if not altogether prevent the expected compensation. It is to overcome this and damp out objectionable harmonics that the reactances are connected in each phase.

The resistance rods or discharge rods shown serve the purpose of discharging the condensers immediately they are disconnected from the line. Fuses

are installed as a safeguard on general principles. The trip coils controlling the circuit breaker are installed to permit disconnecting the condenser should anything happen to make it advisable for the units to clear themselves from the line. No low-voltage or no-voltage release is employed because the condenser may be left connected to the lin if voltage goes off.

The efficiency of the static condenser is very high, about 99 per cent, which makes the losses of other forms of equipment for power-factor improvement appear quite high. Another fact of interest is that the temperature rise of a condenser in continuous service is constant for constant frequency and voltage, and is usually not more than 10 to 15 deg. C. and as the load is a function of voltage and frequency overloads cannot occur with rated voltage and frequency applied.



Schematic Diagram of Static Condenser, Showing Control, Discharge Rods, Reactance, Fuse and Condensers.

Effects of Low Lagging Power-Factors.

Transformers are rated in kilovolt-amperes output; that is, a 100 kva. transformer is supposed to deliver 100 kw. at unity power-factor at normal voltage and at normal temperatures. If the power-factor should be 0.60 lagging, the rated energy output of the transformer would be only 60 kw. and yet the current and, consequently, the heating would be approximately the same as when delivering 100 kw. at unity power-factor. The regulation of transformers is inherently good, being for small lighting transformers about 1½ to 2 per cent for a load of unity power-factor, and about 4 to 5 per cent at 0.70 power-factor. Larger transformers with a regulation of 1 per cent or better at a unity power-factor load would have about 3 per cent regulation at 0.70 power-factor.

Alternating current generators also are rated in kva. output, usually at any value of power-factor between unity and 0.8. The deleterious effects of low power-factor loads on alternating-current generators are even more marked than on transformers. They have decreased kilowatt capacity, decreased efficiency, impaired voltage regulation, as well as the necessity for increased exciter capacity. Assume the case of a 200 kva. generator designed for 0.80 power-factor (160 kw. output). If the power-factor in the circuit supplied by this generator is about 0.60 it is probable that normal voltage could be obtained only with difficulty even though at this power-factor the generator would be delivering only about 120 kw. The lagging power-factor current in the armature sets up a flux which opposes the flux set up by the fields, and in consequence tends to demagnetize them, resulting in low armature voltage. It is often impracticable, without the installation of new exciters, to raise the alternator voltage by a further increase of the exciting voltage and current.

The field losses, and therefore the field heating of the alternator, when it is delivering rated voltage and current, are greater at lagging power-factor than at unity. Increased energy input and decreased energy output both cause a reduction in efficiency. The regulation at 1.0 power-factor of modern alternating current generators capable of carrying 25 per cent overload is usually about 14 per cent. Their regulation at 0.7 power-factor lagging is about 30 per cent.

The following example shows the effect of low power-factor upon a circuit. Assume a line two miles in length is to carry a three-phase 60-cycle load of 100 kw. with a delivery voltage of 2300 volts. The energy loss if to be 10 per cent, would necessitate each conductor having a cross section of 25,000 circular mils at 100 per cent power-factor, 30,820 circular mils at 90 per cent power-factor, and 69,500 circular mils at 60 per cent power-factor. This shows at once that the investment in copper will have to be nearly 2.8 times as great for a power-factor of 60 per cent as for 100 per cent power-factor. Also the energy loss at 60 per cent power-factor will be 2.8 times greater than the loss at unity power-factor, being actually 28 per cent instead of 10 per cent. This simple example emphasizes that high power-factor is imperative for economical investment and for the conservation of energy and equipment.

In determining the necessary extra investment in copper with an operating power-factor of 60 per cent it is found that 3600 pounds more copper is required than were the power-factor 90 per cent. If the price of copper is taken at 20 cents per pound, the cost of having a power-factor of 60 per cent instead of 90 per cent, on account of the increased copper alone is $720, not to mention the cost of stringing it, maintaining it and the interest on this sum. And then the lower power-factor reacts to reduce the capacity of transformers, generators, exciters, and goes back to the coal pile as a source of energy and fuel loss, and interferes with the voltage regulation of the system, all of which could be capitalized.

Condenser Calculations.

When considering the installation of a static condenser for correcting power-factor troubles, a survey of the conditions should be made to determine just what the troubles are, and to what extent they can be remedied by the presence of leading current in the system. The generating capacity in both energy and kva. average and maximum load and power-factor of both generators and feeders, the system of distribution etc., should all be given consideration.

It is obviously desirable to locate the static condenser as near the source of the inductive load as possible in order to avoid the transmission of the wattless current. Because of this it is quite often more eco-

nomical to install a number of relatively small condensers rather than one large one. For this class of service the static condenser is especially suited, as the question of suitable attendance need not be considered. With the location determined, the load and power-factor within its zone determined, the proper size of condenser to raise the power-factor to a given value may be found. For example, assume a 250-kw. load at 0.60 power-factor, and that it is desired to raise raise to 0.90 power-factor.

A 260-kw. load at 0.6 is 250 ÷ 0.60 or 416 kva. apparent load which has a wattless component lagging of $\sqrt{416^2 - 250^2} = 332$ kva. A 250-kw. load at 0.90 = 250 ÷ 0.9 or 279 kva. apparent load that may be expected when the condition of 0.90 power-factor is realized. This has a wattless component lagging of $\sqrt{279^2 - 250^2} = 123$ kva. The difference 332 — 123 = 209 is the leading kva. that will be necessary to raise to 0.90 power factor.

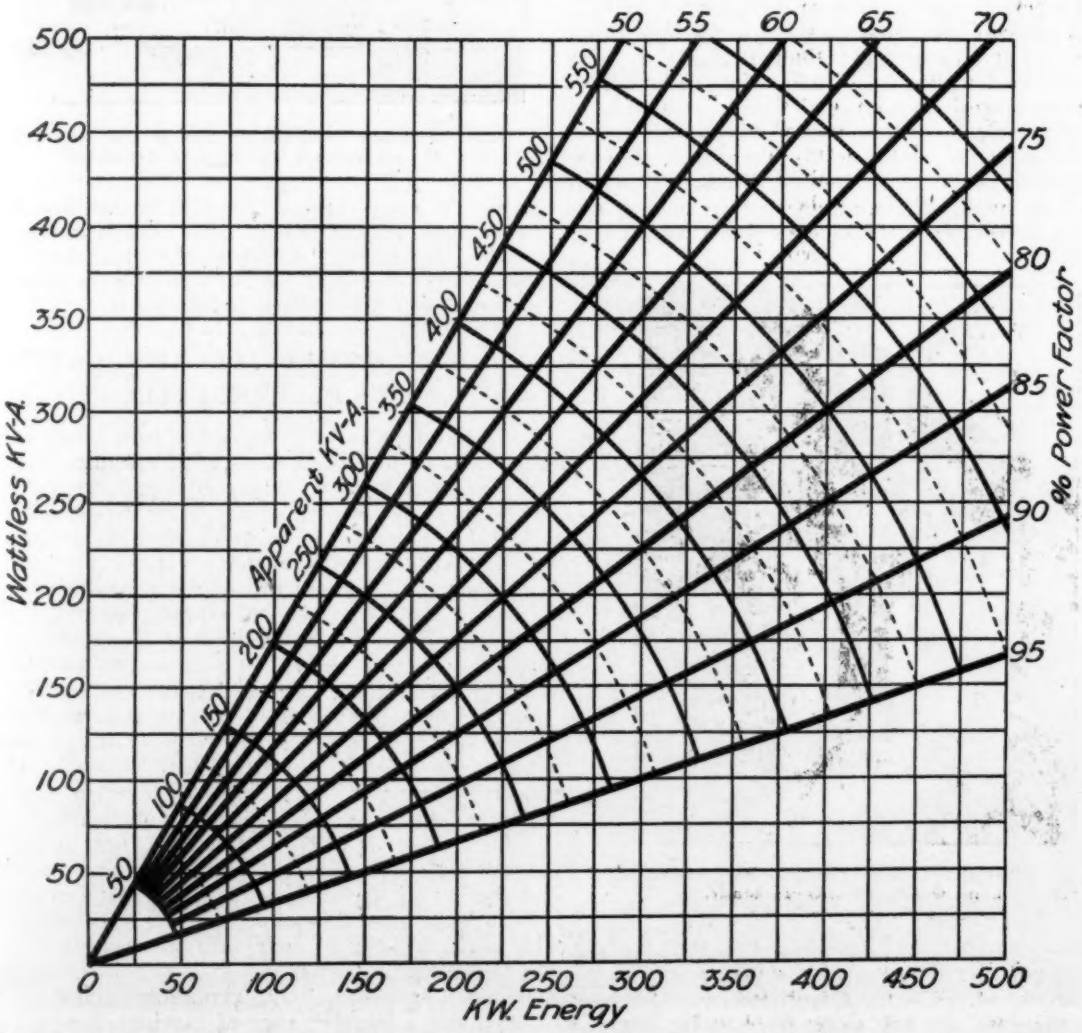
This may be read directly from the accompanying curve. Read up the vertical line at 250 kw. energy to the point where it crosses the 0.60 power-factor line. The apparent load may be read as 415 kva. approximately. Reading from this point to the left margin the wattless component will be found to be 330 kva. Then in the same manner the apparent load at 0.90 power-factor will be found to be 280 kva. and the wattless component read at 125 kva. The difference or 330 — 125 = 205 kva. which is close enough for all practical purposes to a 200 kva. condenser, the nearest standard size.

It will also be found in this case that using a 200 kva. static condenser will make it possible to take on an additional load at 87 kw. at 60 per cent power-factor and still have the same total apparent load while the resulting power-factor would be 81 per cent. In other words, the possible income from the particular feeder in question may be increased 87 ÷ 250 or approximately 35 per cent.

The success with which the static condenser can be used to correct low power-factor conditions, on even most extensive distribution systems, or on shorter lines and isolated plants should appeal strongly to every central-station manager, and to those in charge of isolated plants having inductive loads. Their use may in many cases obviate the necessity for additional generator, transformer, and line capacity and will always conduce to maintenance at the highest possible efficiency the generating plant and distribution system.

Specific Instances of Condenser Performance.

The Lynn Gas & Electric Company, operating an extensive three-phase distributing network, using 60-cycle energy at 575 volts has made three installations in the network. Two of these condensers are housed outdoors in housings; the third is installed in a sub-



Curve Showing Relation of Energy Load to Apparent Load and Wattless Components at Different Power-Factors.

way. The last installation was the subway condenser of 100 kva. and the following table shows the conditions existing before the condenser was installed, why it was installed and what it accomplished:

	Line Amperes	
	With Condenser.	Without Condenser.
Phase "A"	355	517
Phase "B"	360	523
Phase "C"	355	517
Total kva	355	516
Total kw	250	250
Line volts	575	575
Power-factor	71%	49%

It will be seen that the installation of this 100 kva. static condenser in a network carrying 516 kva. before installed, and 250 kw. was able to raise the power-factor from 49 to 71 per cent.

In another instance, mentioned in the ELECTRICAL REVIEW, issue of April 13, 1918, a 2010-volt static condenser installation enabled the power-factor to be increased from 70 to 96 and the kva. to be reduced from 80.4 to 58.2 with a kw. load of 56.

The deleterious effect of lower power-factor, that makes itself apparent all the way from the coal pile to the place in the system where it occurs, is such that it is becoming intolerable these days of shortage of fuel and equipment. In fact, it may almost be said that to allow low power-factor to exist is to be unpatriotic.

The synchonous condenser or motor, with its flexibility of power-factor compensation over a wide range in extremely small increments, and its ability to carry mechanical load, makes it a valuable piece of apparatus where attendance is present, and where the load to be carried mechanically or the correction is of such magnitude as to make its use financially warranted. On the other hand there are a vast number of instances where the load is small, where attendance is lacking and where the investment must be kept down, and it is in

Control Pedestal for 100-kva. Subway Static Condenser, Lynn Gas & Electric Company.

these cases that the static condenser is bound to play a leading part in correcting for the unwelcome lagging wattless current. The more apparent instances where this is the case are out along distributing lines and phase centers, in isolated substations and alongside large transformers, for raising the power-factor locally and thus benefiting the whole system.

More and more attention is being given power-factor improvement by the use of synchronous motors, static condensers, phase advancers and so on as well as the inclusion of a power-factor clause in power

Static Condenser Installed on End of One Feeder of the Schenectady Illuminating Company.

rates, the more careful choice of motors and the aim to maintain higher load-factors. While it may not be always feasible to obtain a high load-factor, it is usually feasible and always desirable to correct for low power-factor, thereby improving it.

A NEW COMMERCIAL APPLICATION OF ELECTROLYSIS.

According to *La Energia Eléctrica* a new small industry has just been started in Valencia, Spain. In this district a large number of small decorative articles are manufactured in clay, glass, wood, and *papier-maché*. Some of these are now being encased in a thin "skin" of metal, which greatly improves the appearance and permanence of the articles.

The method employed is simple. A small compressor supplies air at a pressure of about seven atmospheres to a receptacle filled with metallic powder (generally lead, for cheapness). At the moment the metallic powder emerges from the jet, it is melted by an oxy-hydrogen flame, and a spray of molten metal encases the object to be "metallized," which is placed on a revolving platform. The object then goes to the electrolytic bath, and receives its new skin of copper, silver, or gold. Glass articles are first treated by a sand-blast to ensure the necessary roughness for the adhesion of the lead. A new type of Leyden jar is also being manufactured, in which the old silver-foil is replaced by a homogeneous film of silver.

The firm of Arturo Piera, Valencia, is the Spanish pioneer in this class of manufacture, and is already supplying a large number of carvings, lamps, candelabra, and statuettes for interior decoration at Madrid.

The New 5000-Kilowatt Station at Winona, Minn.

Mechanical and Electrical Features of Wisconsin Railway, Light & Power Company's New Plant at Winona, Minn.

THE Wisconsin Railway, Light & Power Company operates an interesting transmission system in the western part of Wisconsin where water power with steam reserve is used quite extensively and where the interchange of power between transmission systems has been developed to some extent. The company's system consists of a 4800-kw. hydroelectric power plant on the Black River at Hatfield, Wis.; a 45,000-volt transmission line from Hatfield to Winona, Minn.; a modern 5000-kw. steam power plant at Winona, and a branch 45,000-volt transmission line extending to the city of LaCrosse, Wis. The company operates the street railway system of LaCrosse, Wis., and the street railway and light and power system of Winona, Minn. A considerable number of small towns are supplied from the transmission line and by distribution from the Winona plant. The company furnishes all the power requirements of the rapidly growing transmission system which supplies the small towns in southeastern Minnesota.

Its system is connected to an extensive tranmission system to the north and is also connected to the local light and power system of LaCrosse, Wis.

In line with the great present need of utilizing our water powers to the fullest extent by interconnection of systems, it is interesting to note that the exchange of power has been worked out advantageously in this locality.

In order to adequately provide the system's rapidly growing load in times of low water, the Wisconsin Railway, Light & Power Company recently constructed a 5000-kw. steam plant at Winona. This plant embodies a number of very up-to-date features and will, therefore, be described at some length.

The Winona plant of the Wisconsin Railway, Light & Power Company is built on the bank of the Mississippi River, midway between the river and the railroad tracks of the Chicago & Northwestern Railroad, as shown in plan in Fig. 2. As time goes on and extensions of the station become necessary, the station will be extended parallel to the Mississippi River. The station structure is built up of a

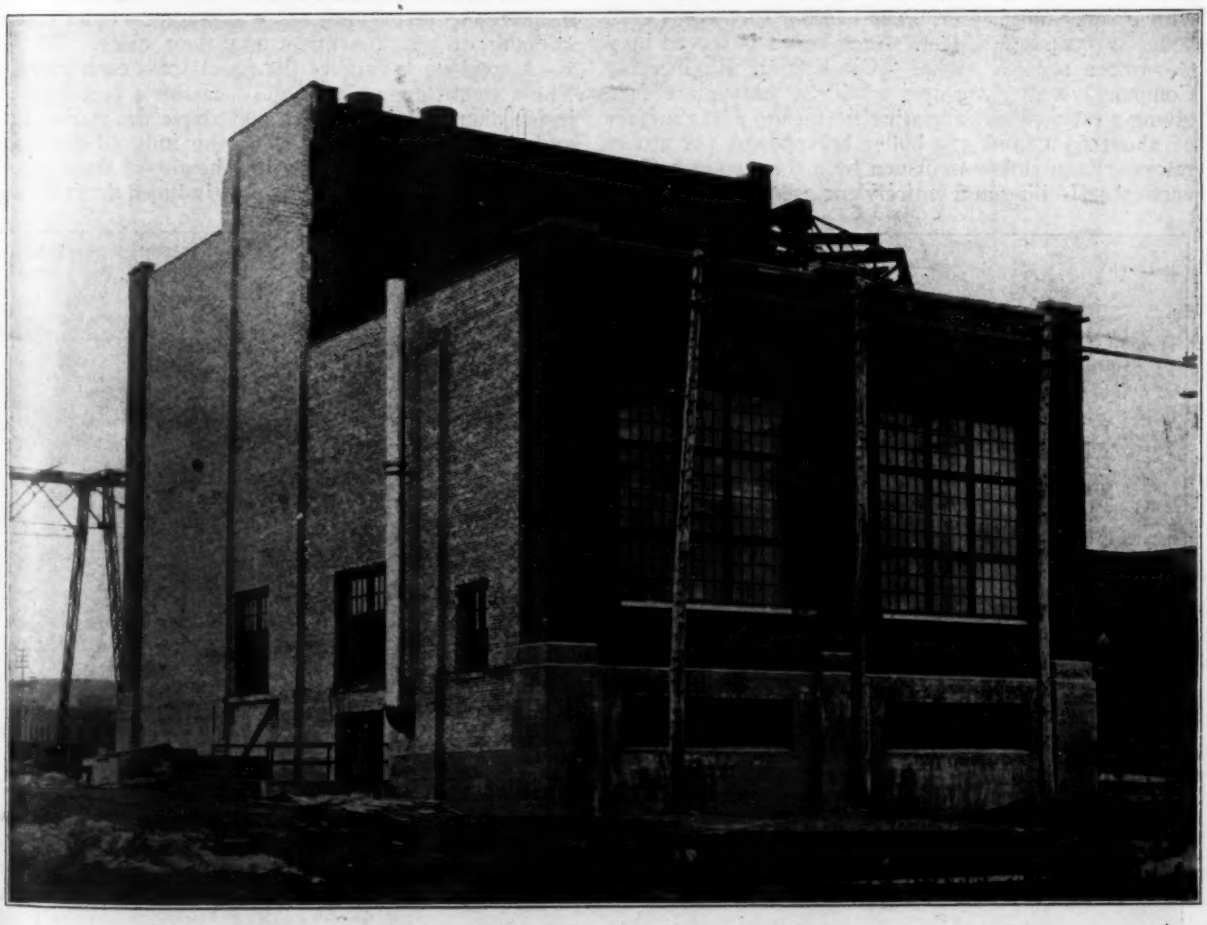


Fig. 1.—External View of Winona, Nearing Completion.

structural steel frame and brick—red brick for the front of the building and the side that is expected to be permanent, and yellow for the side that will have to be removed when additional units are installed. The foundations upon which the station rests, largely made-up land and subject to seepage from the Mississippi when swollen, are such that the station basement floor is heavily reinforced to prevent any tendency for upward water pressure.

The initial boiler-room equipment comprises the necessary apparatus for supplying steam to one 6250-

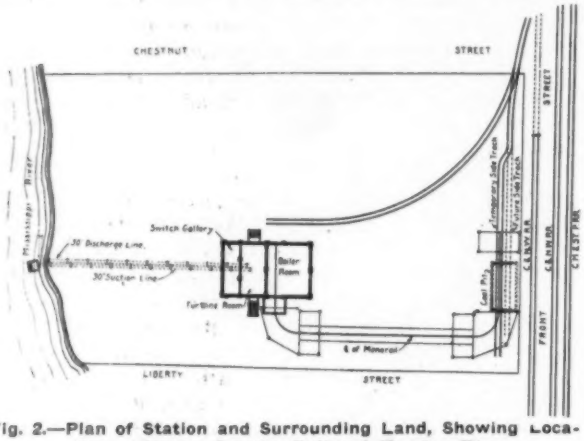


Fig. 2.—Plan of Station and Surrounding Land, Showing Location of Water Supply, Railroad Tracks, Etc.

kilovolt-ampere turbo-generator. There are two 750-horsepower B. & W. Stirling boilers, each equipped with Foster superheater. The heating surface of each boiler is 7524 square feet. Each boiler is served by a two-retort type E stoker (Combustion Engineering Company) with grate area of about 120 square feet, giving a ratio of boiler heating surface to grate surface of about 63:1, and 375 boiler horsepower per stoker retort. Each stoker is driven by a 9 by 10-inch Troy vertical self-oiling and entirely enclosed engine.

Each boiler is equipped with an economizer. These are Sturtevant vertical tube units, having 216 tubes, 9 feet long and 4-9/16-inch outside diameter. The individual heating surface is 2685 square feet, giving a ratio of boiler to economizer heating surface of about 2.8:1. Scrapers are used for removing soot from the tubes. With a stack temperature of 500 degrees Fahrenheit and water entering at a temperature of 110 degrees Fahrenheit, these economizers are able to raise the temperature of the water to 200 degrees Fahrenheit, a rise of 90 degrees, corresponding to operation at normal rating of the boilers. When running the boilers at 200 per cent rating, flue gases at 600 degrees Fahrenheit, and water entering the economizer at 130 degrees Fahrenheit, the economizers are able to raise the temperature of the water 100 degrees, so that the water leaves the economizer at a temperature of 230 degrees Fahrenheit.

The forced-draft fan for supplying air to the fuel bed, located immediately beneath the station, supplies both boilers and was furnished by the American Blower Company. It is a 40-inch unit, driven by either one of two 9 by 10-inch Troy vertical self-oiling, enclosed engines, and is capable of delivering 40,000 cubic feet of air per minute at any time of the year. An induced-draft fan handles the gases of each economizer. These fans are Sturtevant No. 9 multivane blowers, and are capable of handling 20,000 to 40,000 cubic feet of gas at 375 degrees Fahrenheit per minute. These blowers are driven by 35-horsepower variable-speed induction motors.

The floor space occupied by each boiler and stoker measures 17 feet 6 inches in width and 19 feet 7 inches in depth, or 342 square feet total floor space.

A steel stack handles the gases from each furnace. These stacks are unlined and measure 4 feet 6 inches inside diameter, and are 20 feet above the station roof and 30 feet above the top of the induced-draft fan outlet. The comparatively low height of these stacks is, of course, due to the fact that induced draft is used

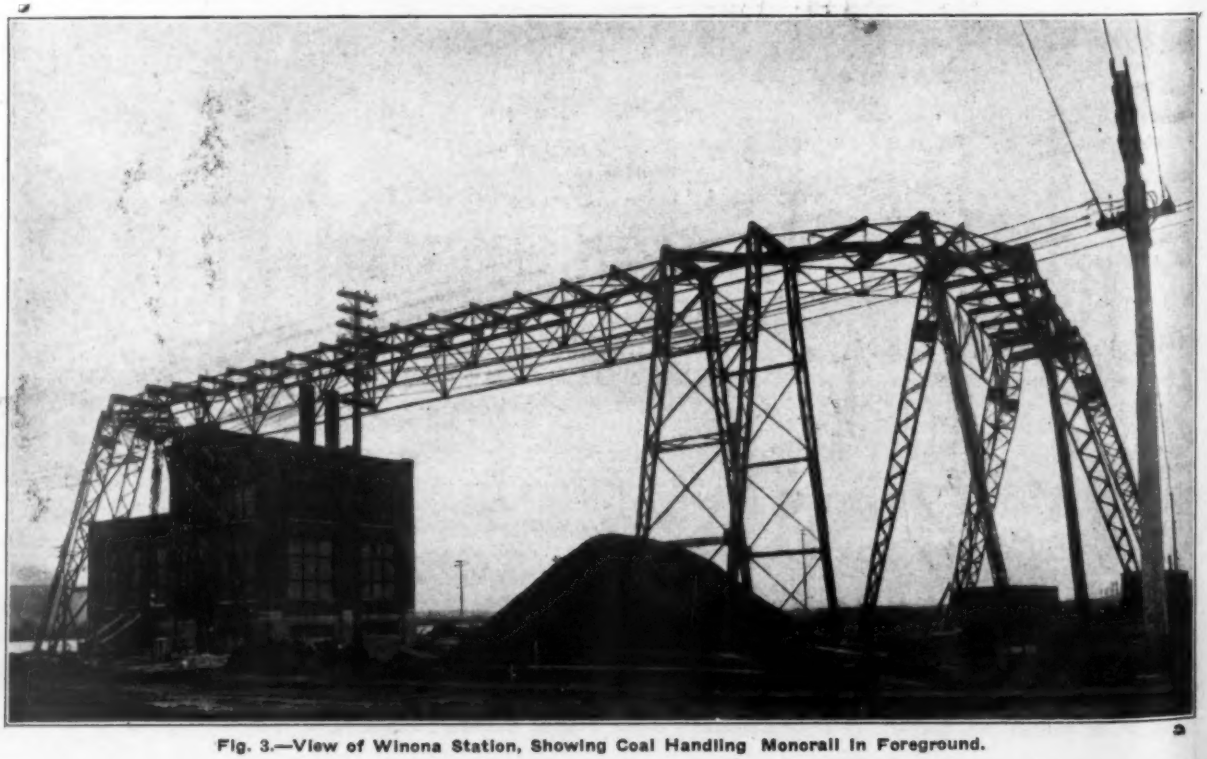


Fig. 3.—View of Winona Station, Showing Coal Handling Monorail in Foreground.

and because dwellings and other structures are not in sufficiently close proximity to the plant to cause concern as to the falling of flue-gas dust, cinders, etc.

One Allis-Chalmers high-pressure steam turbine, geared to a multi-stage centrifugal feed-water pump, supplies both boilers. All feed-water is heated by a Hoppes feed-water heater, which is not, however, automatically controlled. Make-up water passes through a screen as it comes from the Mississippi River and then passes through a Bartlett-Graver water softener and purifier having a capacity of 1000 gallons per hour. The make-up water is not measured.

as possible. Fig. 2 shows the general layout of the tracks for handling both coal and ash.

Coal is dumped directly from the spur track on the Chicago & Northwestern Railway into a pile. From this pile, or direct from the coal cars, coal is picked up by grab bucket and carried along the P. & H. monorail into the station. At the station the monorail passes directly below the roof, over the boiler room to the hoppers of each boiler, where the coal is dumped.

The apparatus for taking out the ash is as simple and direct as that for taking the coal in. The ash is dumped into cars in the basement by gravity on

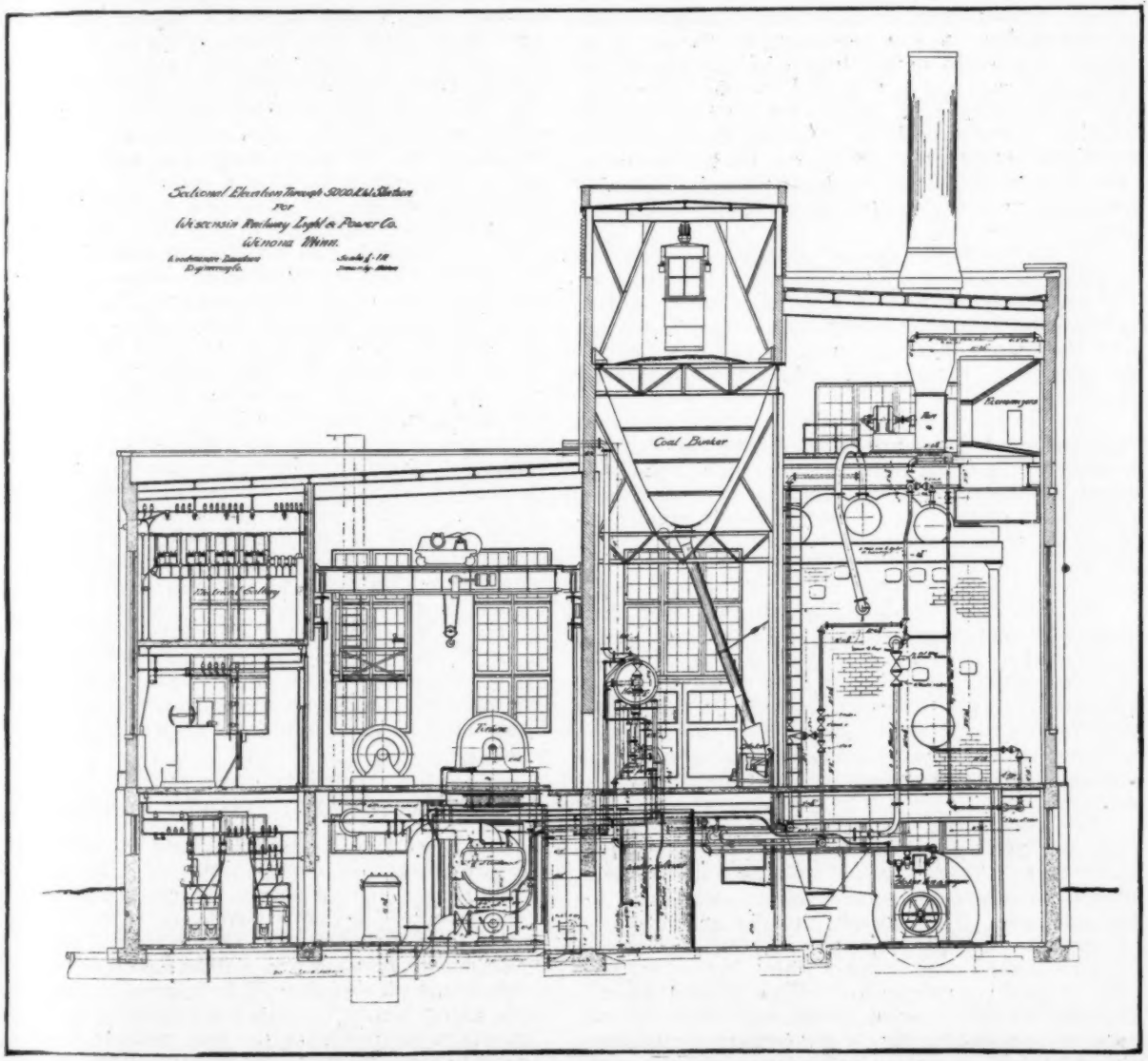


Fig. 4.—Sectional Elevation Through Winona Station.

Each boiler is equipped with a steam-flow meter, draft gauges, and curve-drawing pyrometer, and is piped for drawing samples of flue gas. An Orsat apparatus is used for flue-gas analysis.

An individual bunker supplies each boiler with coal. The capacity of each is 150 tons.

Coal and Ash Handling.

The coal and ash handling equipment has been designed so as to eliminate all lost motion, by making the movement of coal inward and ash outward as direct

opening the doors of the ash hopper. The cars are run along the basement to an hydraulic lift, which elevates them to the track shown in the plan in Fig. 2. The ash-handling track can be readily extended.

Every effort has been made to make the coal and ash handling as simple as possible, so that a minimum of human effort is required to handle it. The coal hoppers and grab bucket are of such capacity that sufficient coal can be loaded into them during the normal hours of daylight without it being necessary to carry on work at night. Several days' supply of coal is car-

ried in the bunkers to insure against delays due the elements, the railroads and other uncontrollable causes.

Turbine and Its Auxiliaries.

In the turbine room is situated in addition to the prime mover and its generator, one 150-kilowatt motor-generator set and one 300-kilowatt synchronous converter for supplying direct current at 550 volts to the trolley system. A Pawling & Harnischfeger crane with lifting capacity of 25 tons serves the turbine room. This is equipped with a 22 horsepower motor for the hoist and a 7½ horsepower motor for the trolley, both operating at 440 volts.

The turbine is a standard Allis-Chalmers 6250 kilovolt-ampere machine, operating at 3600 r. p. m. Steam is delivered to the throttle at 250 pounds per square inch and at 125 degrees Fahrenheit superheat. Raw water is supplied for cooling the lubricant, but softened water is used for steaming glands, because the higher temperatures of these latter tend to throw down deposit from the untreated water. The turbo-generator measures 36 feet 7⅜ inches over all and 9 feet 9¾ inches wide.

A Westinghouse-Leblanc surface condenser is installed directly beneath the turbine. This condenser has 1910 tubes, each of 16 feet active length and ¼ inch outside diameter, giving a total cooling surface of 6000 square feet being equivalent to 1.2 square feet of condenser surface per kilowatt of generator capacity.

The circulating, Leblanc or air, and hotwell pumps serving the condenser are driven on the one shaft, as is standard Westinghouse practice, by a 150-horse-power variable-speed induction motor. The circulating pump has a capacity of 75,000 gallons per minute, referred to 28-inch vacuum.

Electrical Features.

The generator is an Allis-Chalmers three-phase turbo-alternator, star-connected with neutral brought out, operating at 3600 r. p. m. with a terminal voltage of 4000. Its rating is 6250 kilovolt-amperes, or 5000 kilowatts at 80 per cent power-factor. The exciter for this unit is a compound-wound, 125-volt direct-current machine with a capacity of 27½ kilowatts and is connected to the turbogenerator shaft on the generator end.

The switchboard and oil circuit breakers are of General Electric manufacture. The generator is protected by a G. E. 4500-volt K-12B oil circuit breaker, with 1000-ampere disconnect switches installed on the bus side only. The 440-volt, three-phase, 150-horse-power motor driving the condenser auxiliaries is supplied from three transformers which in turn are supplied at 4000 volts through an oil switch and selective switches. These selective switches are double-throw, making it possible to supply the condenser auxiliaries either from the generator leads at a point between the generator and the generator switch or from the bus. In this way the auxiliaries will continue to operate even though the main generator switch may trip out. By placing the selective switches in the other position these condenser auxiliaries may be operated from the station bus while the turbogenerator is starting.

To the main bus are connected three single-phase 110-kilowatt transformers, connected star-delta, voltage ratio 2400/2160 to 370/185 for supplying the 300-kilowatt synchronous converter for railway service; three single-phase transformers, connected star-delta, voltage ratio 2200/6600, for supplying energy to 6600-volt feeders; three single-phase star-delta transformers furnishing 440 volts for station power and one 10 kv.a. single-phase transformer for station lighting. The arc bus with its one 25-light and its two 50-light tub regulators and the 4000-volt outgoing feeders, which are three-phase three-wire, are also connected to the main bus.

All disconnects for generators and feeders and much of the pipe framework were supplied by the Electrical Engineers Equipment Company. The location of the various electrical apparatus, as other equipment, can be seen in Fig. 4.

It is interesting to note that the primary distributing system, together with the wiring of several old generators, motor-generators and a former station bus, were all 2300 volts, three-wire. When the new turbine was put into operation the old 2300-volt three-wire was gradually changed over to the new four-wire system with 4000 volts between phase wires and 2300 volts between each phase wire and ground. This 4000-volt, four-wire system was adopted because of the fact that a three-phase load on a 4000-volt feeder will cause a percentage line drop only one-third as large as it would be if operating at only 2300 volts. Better voltage regulation with lower investment for copper are the advantages of this system. Single-phase loads such as lighting transformers and street lighting series transformers are connected from a phase wire to the neutral wire using standard 2200-volt transformers. Power transformers are connected in "Y" on the primary and delta on the secondary, also using 2200-volt standard transformers.

As the neutral point of three-phase transformer banks should not be connected to the circuit neutral, the neutral or fourth wire is ordinarily not installed as a part of a strictly power feeder but is made a part of all combined power and lighting feeders or strictly lighting feeders. The success of the 4000-volt, four-wire system since its installation has demonstrated the wisdom of changing to this higher voltage.

The Winona station of the Wisconsin Railway, Light & Power Company was designed by Woodmansee-Davidson Engineering Company, Chicago, and was erected under their supervision. Worden-Allen Company, Chicago, were the contractors erecing the building.

CO-OPERATION IN UTILITY OPERATION.

The State Legislature, Louisiana, has approved a measure authorizing cities, towns and villages in the state to unite and co-operate where desired for the construction and operation of electric interurban railway systems, including the construction and operation of electric power plants as a source of service. The fundamental idea of the bill is to provide cheap and rapid transportation facilities throughout the state, and throughout its provisions the new measure is closely similar to one recently passed in Mississippi.

BRIQUETTING IN CANADA.

The Canadian Council for Scientific and Industrial Research intends to manufacture carbonized lignite briquettes. A plant costing about $400,000 will be constructed near Estevan, Saskatchewan. It is proposed to take two tons of poor lignite containing about 32 per cent of moisture and 7300 B. t. u. per pound, and turn them into one ton of briquettes containing 5 per cent moisture, with a fuel value of 12,000 B. t. u. Sulphite liquor, the waste product from pulp mills, will be used as the binder; it is smokeless and odorless.

Editorial Comment

Improving Power-Factor By Static Condenser

SO FAR the static condenser has found comparatively small application for power-factor improvement. In fact, it is being used only in a very restricted sense, in cases few and far between. One reason for this is that realization has not yet come as to its wide field of usefulness, although perhaps the chief reason is that it is not as flexible as the synchronous condenser and its value has not been appreciated to the full. With the static condenser the leading wattless current is a constant value for constant applied voltage and frequency, whereas the synchronous condenser by being able to vary its over-excitation is also able to vary the leading wattless component of current over quite a wide range. Thus the one is able to improve power-factor, the other control it to a certain extent.

The fundamental disadvantage of the static condenser for power-factor improvement, namely, its lack of flexibility, is not, however, as weighty as might at first appear; indeed, this piece of apparatus possesses many very real advantages over the synchronous condenser for certain classes of work. It is extremely efficient, being about 99 per cent efficient; its cost is lower than that of the synchronous condenser and it occupies less space; vibration does not exist and rotating and moving parts are absent, and much like that sturdy piece of apparatus, the distributing transformer, when once installed, may be left alone almost indefinitely. In fact, the ability of the static condenser to remain operative without attention and ability to use it in small sizes where such small synchronous condensers would hardly be feasible and at best costly, are the two predominating factors in making the static condenser superior to the synchronous condenser for certain classes of power-factor improvement.

For a fairly steady load at fairly steady power-factor a fairly steady leading wattless current suffices to counteract for the constant lagging wattless current. That is, the static condenser suffices for improving the power-factor of such a load. The installation of a synchronous condenser with its higher first cost and expense of operation and lower efficiency, and greater and more flexible control may not be warranted under such conditions. The flexibility of a synchronous condenser is worthwhile only when it can be utilized. Thus the static condenser has its rightful field, and one possessing quite definite demarkation, namely, constant correction for constant conditions, or at least conditions that remain constant within fairly narrow limits, for small capacities and where small correction is required where actually needed.

A utility with its lines and apparatus back of them overloaded or taxed with wattless current is powerless to remedy matters if the customer refuses to change his load, equipment or operating methods and lacking a power-factor clause in the power rate to penalize for injuriously and needlessly low power-factor. In such cases the utility will often find the static condenser installation the best way out of a dilemma, and the most economical way, obviating the necessity for reenforcing conductors and enlarging capacity. In fact, it seems a good policy before attempting to remedy low power-factor to equate the relative cost of eliminating it against that of making it less deleterious. And then a customer may be well able and it may be financially desirable for him to correct his own power-factor, but it would be unwise for him to have it within his own power to control that of other customers on the system. The static condenser, installed by the utility at the individual load, at the center of gravity of loads, phase centers and other judicious places, is able to take care of average or the worst conditions existing. This is what is being done by the Schenectady Illuminating Company, as told elsewhere in this issue.

The static condenser for power-factor improvement in this country has followed its use in European countries, hence its use here has not yet made the same headway that it has "over there." Conditions are favorable to its far wider application, and increased improvements in design and the reduction in cost that comes with increasing production all tend to encourage its more intensive application as time goes on. There are other applications of the static condenser that may be expected to come into more extensive use as time goes on—the protection of field coils against induced potentials during starting or field discharge, the protection of direct-current circuit-breaker contacts on opening under extremely heavy amperage, the exciting source of induction generators as well as phase splitting, and so forth.

For improving power-factor, which means relieving apparatus and extending its usefulness and bettering voltage regulation, in subways, transformer vaults, networks and isolated loads where attendance is lacking or supervision remote, or where the magnitude of the load of correction required is so small as not to warrant the use of a synchronous condenser, even if feasible otherwise, the static condenser should find increasingly wide application.

Low power-factor is inimical to efficiency and conservation. It is unpatriotic to allow a system to become loaded up with preventable wattless current, that is by no means wattless when figured back to the coal pile, nor harmless when judged by its effect upon

apparatus. To allow low power-factor these days is not only extravagant but unpatriotic.

Is The Fan an Essential or a Luxury?

THE Ways and Means Committee of Congress proposes to place the electric fan among the non-essential things of life, class it as a luxury and subject it to a specially high tax.

The electric fan is indeed a luxury these days, but it is a necessity, too. It is as the bread of life. The fan is the nearest approach many of us have to conditioned air; reducing as it does the humidity and heat in summer, and circulating warmth in winter. Winter and summer the fan is useful in making bodily comfort, creating ease, all conducive to health and efficiency.

The summer is passing, the use and demand for the fan subsiding, and its production will follow the natural laws of supply and demand. Taxation will only add another deterrent to fan production. But a tax will not prevent the purchase of fans by those who have not been discouraged or hindered in buying automobiles because of the tax on them and the high cost of gasoline and similar "luxuries." But a tax will interfere with and possibly prevent many people who need the fan from obtaining one.

In the interests of the little children of the poorer class families, on behalf of the invalids and those whose health depends upon ample ventilation, on general principles of comfort, health and efficiency in living, we feel the taxation of fans, per se, not only needless but undesirable. No one would ask that ventilating fans be abandoned or discouraged in factories and buildings, lest vitiated and stagnant air injure the health and make the workers less productive and less capable. Yet the fan in the office and the home serves much the same purpose as the ventilating fans and blowers in the factory. Both aim to increase the circulation of air, bringing in oxygen and freshness, carrying away air vitiated and chemically charged with the poisons of the body and industry undertakings. Stagnant air is inimical to health, anathema to human welfare.

In Chicago, almost every manufacturer and jobber reports their stocks of fans depleted and in many cases exhausted. Why? Certainly not because they are a luxury, and people want to spend more money on a luxury when they are spending so much on Liberty bonds, savings and thrift stamps, the Salvation Army, Y. M. C. A., for the Belgian children, and similar noble causes. No, certainly not. Fans have been sold because they were essential in maintaining health and comfort during the torrid weather, because without them persons would become unfit and less efficient. We cannot help but wonder how the Ways and Means Committee would fare if they carried on their work in the quarters that are occupied by many of those working to win the war, with little of life's necessities, let alone luxuries. The fan might be a luxury in some far-off foreign land, but it is a necessity in the city of present-day life when the temperature hovers around 101.

The production of electric fans, with changing seasons, will take care of itself without being burdened by taxation. If the Ways and Means Committee must raise money, let it tax our eats, our smokes, our hard-earned incomes; in fact, our all. But do not tax the air we breathe, for obtaining which the fan is almost an absolute necessity to toilers of the city tied down to their work these torrid days.

The Skip-Stop

THE skip-stop, which means cutting out many needless stops of street cars, is rapidy being adopted. Chicago has at last invoked this mode of saving fuel and time, and many more cities will doubtless follow suit, if not immediately, as soon as the fuel situation begins to pinch. The skip-stop, new to us and initiated as a war measure, has been in vogue for many years in a number of European cities; in some since the electric street car or "tram" first made its appearance. It is the commonsense thing, this skip-stop. It possesses all the advantages for city traction, though modified, that the express train possesses over the local that stops at every signal from persons along the way, or delays to pick up freight in waiting.

The skip-stop has been requested by the Fuel Administration as a means of saving fuel. It is estimated 400,000 tons can thus be saved annually, a small percentage of total coal consumed perhaps, but a goodly quantity and well worth saving. But the skip-stop means even more than fuel saving. It means less wear and tear on brakes and equipment generally. It means less wear and tear on the motorman, which is to the good. Fewer starts and accelerations mean not only lower energy consumption per mile but a reduction in time required to travel a given distance, thereby conserving the time of travelers and making equipment available for a higher rate of work. The longer periods of coasting and more gradual stops allow the cars' momentum to do its bit toward winning the war by saving time, materials and the labor that goes with them.

The skip-stop is one of those measures that can be adopted with all its advantages, without any serious disadvantage. For a while there may be an increased number of accidents due carelessness on the part of pedestrian and vehicular traffic, but that will soon remedy itself. In fact, the skip-stop is a measure singularly lacking in disadvantages.

As a nation we have opposed the skip-stop, perhaps unthinkingly. But when we become accustomed to it we like it. It is one of those measures instituted during the war because of the war—a fuel-saving measure—that will, we hope, stay when the war is won, because it relieves our utilities, makes them more efficient, improves city transportation and conserves coal.

Week's Events

American Institute Committees—Utility Session at Safety Congress — Limitations on Coal Storage — Other News

NITRATE PRODUCTION AT MUSCLE SHOALS NOT AFFECTED BY ORDER.

Ordnance Department States Suspension of Power-Plant Work Will Not Hinder Production.

The production of nitrates for the Government will not in any manner be affected by the recent order causing the temporary suspension of work on the water-power development at the Muscle Shoals nitrate plants, according to a statement just issued by the Ordnance Department.

This order was issued upon representations made by the War Industries Board to the effect that the materials used in the erection of the water-power plant on the Tennessee River, should be regarded as non-essentials. The effect therefore is to stop only the erection of the plant, power from which was not anticipated for some four or five years.

The development of this water-power project was undertaken by the War Department in line with its established policy of utilizing these plants for the production of nitrates for use in agricultural pursuits after the war is over, by which time the water power would be available.

The work on the Muscle Shoals plants is progressing rapidly, one of which is about 60 per cent complete, and over 20,000 men are now employed there. Ample power for the operation of these plants is obtained from a steam-electric station erected on the Tennessee River, and also purchased from the Alabama Power Company.

The Government water-power project on which work has been suspended, was projected for the purpose of obtaining an adequate supply of cheap power in later years.

WAR CONVENTION OF NEW ENGLAND SECTION.

Tenth Annual Meeting to Be Held in Springfield—Program Confined to War-Time Discussions.

The tenth annual convention of the New England Section, National Electric Light Association, will be held at Springfield, Mass., September 27 and 28. Headquarters will be at the Hotel Kimball. The program will be devoted to a discussion of problems in the industry due to the war, particular attention having been given to the question of coal conservation.

The program is as follows:

Friday, September 27: Address of the President, Treasurer's Report, Secretary's Report, Trade Acceptances, by a representative of the Federal Reserve Bank, Finances, Financing of Extensions, Line Extensions in War Time, Raising of Rates and Coal Clauses, Interesting Your Customers in the Securities of your Company and as Stockholders, War Finance Corporation, by a representative of the Federal Reserve Bank, Female Employment in Utilities Service, Wholesale Power—How It Is Being Handled, Interconnection and Power Requirements.

The coal situation will be discussed on Friday evening by a representative of the Fuel Administration of Washington.

Saturday, September 28: Increase in Wages, Bonuses, Etc., Standardization of Transformer Ratings, Making Quality and Service the Basis for Price, by John J. Gibson, Obtaining Power from Steam Used in Bleacheries, Effect of Daylight Saving on Central-Station Incomes, Co-operation Between Different Branches of the Industry, by W. L. Goodwin, Stimulating Appliance Sales, Election of Officers.

The convention committee is composed of W. L. Mulligan, L. J. Scott, R. W. Mitchell and F. Rogers, Jr., all of Springfield, and H. M. Parsons of Palmer.

Miss O. A. Bursiel, 149 Tremont street, Boston, is secretary of the Association.

CALIFORNIA COMMISSION RULES ON INDUCTIVE INTERFERENCE.

Important Order Covers Investigation Covering Period of Five Years.

The Railroad Commission of the State of California has recently issued a General Order No. 52, "In the Matter of the Construction and Operation of Power and Communication Lines for the Prevention or Mitigation of Inductive Interference." This order became effective August 1, 1918, and supercedes General Order No. 39, which was issued in 1914.

The rules contained in this order are based on the results of five years' investigation carried on in California by the Joint Committee on Inductive Interference, and on the recommendations made by this committee in their final report to the Railroad Commission.

The principle of co-operation between all parties involved has been strongly emphasized throughout as the means for determining the best methods for the prevention or mitigation of inductive interference.

A number of rules of a precautionary nature are given, not limited to the lines involved in parallels and apparatus connected thereto, but applying to all new installations.

The most important points covered by the rules are, in brief, as follows:

I. General Provisions.—The essential points considered are the applicability of rules, principles of least cost, co-operation and the relation of existing parallels to these rules.

II. Location of Lines.—Distances between lines, notice of intention and avoidance and length of parallels are considered under this head.

III. Design and Construction of Lines.—Rules relating to transposition and to the arrangement and spacing of power conductors are given.

IV. Design, Construction and Arrangement of

Apparatus.—Rules under this head consider the design, construction and arrangement of transformers, switches, lightning arresters, rectifiers, fuses, special instruments and communication apparatus.

V. Operation and Maintenance.—Under this head balance of lines and the operation of transformers and method of switching and charging lighting arresters are the main points considered. Abnormal conditions of the power circuit are also considered.

A number of definitions are given preceding the rules defining certain technical terms employed.

The Railroad Commission has deemed it unadvisable to make the order retroactive and on this basis its application is limited generally to new construction, except those rules dealing with maintenance and operation of lines. The principle embodied is that all newly reconstructed plant, as it is installed or rebuilt, shall be made to conform to the order.

AMERICAN INSTITUTE APPOINTS COMMITTEES.

First Meeting of Board of Directors for New Year Held on August 13.

The first meeting of the Board of Directors of the American Institute of Electrical Engineers for the administrative year beginning on August 1, 1918, was held at Institute headquarters, New York, on August 13, 1918.

There were present: President C. A. Adams, Cambridge, Mass.; Vice-president William B. Jackson, Chicago, Ill.; F. B. Jewett, New York, N. Y.; John B. Taylor, Schenectady, N. Y.; Managers N. A. Carle, Newark, N. J.; Charles Robbins, Wilfred Sykes, and Frank E. Newbury, Pittsburgh, Pa.; Walter A. Hall, Lynn, Mass.; William A. Del Mar and Walter I. Slichter, New York, N. Y.; G. Faccioli, Pittsfield, Mass.; Treasurer George A. Hamilton, Elizabeth, N. J., and Secretary F. L. Hutchinson, New York, N. Y.

President Adams announced the appointment of the committees for the administrative year. The chairmen of the committees appointed are as follows: Finance, N. A. Carle, Newark, N. J.; Meetings and Papers, W. I. Slichter, New York; Editing, Henry H. Norris, New York; Safety Codes, Farley Osgood, Newark, N. J.; Board of Examiners, F. L. Rhodes, New York; Sections, W. A. Hall, Lynn, Mass.; Student Branches, C. Francis Harding, Lafayette, Ind.; Membership, H. A. Pratt, New York; Public Policy, Calvert Townley, New York; Headquarters, N. A. Carle, Newark, N. J.; Electrical Engineering Service, Wm. A. Del Mar, New York; Code of Principles of Professional Conduct, George F. Sever, Washington, D. C.; Standards, L. T. Robinson, Schenectady, N. Y.; Power Stations, Philip Torchio, New York; Transmission and Distribution, L. E. Imlay, Niagara Falls, N. Y.; Traction and Transportation, C. F. Uebelacker, New York; Industrial and Domestic Power, A. G. Pierce, Pittsburgh, Pa.; Lighting and Illumination, C. E. Clewell, Philadelphia, Pa.; Economics of Electric Service, W. B. Jackson, Chicago, Ill.; Protective Devices, D. W. Roper, Chicago, Ill.; Electrochemistry and Electrometallurgy, Carl Hering, Philadelphia, Pa.; Electrophysics, F. W. Peek, Jr., Pittsfield, Mass.; Telegraphy and Telephony, Donald McNicol, New York; Marine, H. A. Horner, Philadelphia, Pa.; Use of Electricity in Mines, K. A. Pauly, Schenectady, N. Y.; Electrical Machinery, Alexander M. Gray, Ithaca, N. Y.; Instruments and Measurements, S. G. Rhodes, New York; Iron and Steel Industry, Eugene Friedlaender, Braddock, Pa.; Educational, V. Karapetoff, Ithaca, N. Y.

In accordance with the by-laws of the Edison Medal Committee the Board elected from its own membership Charles Robbins, C. E. Skinner and Walter I. Slichter to serve upon the committee for the term of two years. F. B. Jewett, John B. Taylor and Harold Pender were elected by the Board to serve upon the committee for one year ending July 31, 1919, to fill the unexpired terms of three retiring members of the Board of Directors.

Local Honorary Secretaries were reappointed for the two years ending July 31, 1920, as follows:

Robert Julian Scott, New Zealand; T. P. Strickland, New South Wales; W. G. T. Goodman, South Australia; James S. Fitzmaurice, West Australia; L. A. Herdt, Province of Quebec; Henry Craftio, Russia; A. S. Garfield, France; Harry Parker Gibbs, India; John W. Kirkland, South Africa.

Arrangements made by the Meetings and Papers Committees were approved by the Board for Institute meetings to be held in Philadelphia October 11-12, 1918, and in Toronto on November 22, 1918.

PUBLIC UTILITY SESSION AT SAFETY CONGRESS.

Seventh Annual Safety Congress of the National Safety Council to Be Held at St. Louis.

The co-ordination of America's resources for the winning of the world war will take on added significance the week of September 16 to 20, when the seventh annual Safety Congress of the National Safety Council convenes at the Hotel Statler, St. Louis, Mo.

A message emphasizing the pressing need for the conservation of man power will be received from President Woodrow Wilson, a member of the Cabinet delivering the principal address at a public meeting to be held the opening days of the convention—"Safety as an Asset in Winning the War," by the Hon. Franklin K. Lane, will express the views of our national government in its determination to prevent every avoidable accident in industrial America. Charles M. Schwab, director of the Emergency Fleet Corporation, will give the principal address at the opening session of the convention, his subject being, "The Democratization of Industry."

David Van Schaack, president of the National Safety Council, will call the Congress to order Monday morning, September 16, at 10 o'clock, awarding the place of honor to Mayor Henry W. Kiel, mayor of St. Louis, who will formally welcome the delegates and visitors, and the first business session of the convention will occupy the remainder of the forenoon.

Tuesday, Wednesday, Thursday and Friday will witness the inauguration of sectional meetings, where the delegates will gather to discuss problems of accident prevention peculiar to their calling or industry. Each sectional meeting will be followed by an experience meeting, and employers, safety committeemen and others will have full opportunity to tell their experiences in safety work or ask counsel and advice.

The program for the public utilities sectional meeting, which will be held Wednesday morning, September 18, is as follows:

I. "Interesting the public in Co-operative Accident Prevention," by Herman Spoehrer, secretary and treasurer, Union Electric Light & Power Company, St. Louis, Mo.

Discussion, by Charles B. Scott, general manager, Bureau of Safety, Chicago, Ill.

II. "Theoretical Possibilities and Practical Values of Accident Prevention," by Herbert W. Moses, superintendent welfare bureau, Edison Electric Illuminating Company of Boston, Boston, Mass.

Discussion by James B. Douglas, manager claim department, United Gas Improvement Company, Philadelphia, Pa.

III. "First Aid to the Injured and Its Bearing on Accident Prevention," by John Bailey, superintendent of safety, Bell Telephone Company, Philadelphia, Pa.

Discussion by Walter A. Calihan, Rochester, N. Y.

IV. "Practical Demonstration of Resuscitation Methods," by H. B. Harmer, safety engineer, The Philadelphia Electric Company, Philadelphia, Pa.

Discussion by W. P. Strickland, general inspector, New York & Queens Electric Light & Power Company, Long Island City, N. Y.

V. "Modern Practical Methods of Accident Prevention in Small Companies," by Wills Maclachlan, inspector, Electrical Employers' Association of Ontario. Toronto, Ont., Can.

Discussion by E. R. Dobbin, Empire Gas & Electric Company, Geneva, N. Y.

C. B. Scott, general manager of the Bureau of Safety, Chicago, will act as chairman of the utility meeting.

U. S. NAVY STEAM ENGINEERING SCHOOL.

Full Particulars Regarding School Established by Training Engineer Officers.

The U. S. Navy Department has perfected plans for the enrollment and training of considerable numbers of engineering officers. A school for this purpose, the U. S. Navy Steam Engineering School, has been established by the department at Hoboken, N. J.

The school is open to men between the ages of 21 and 40 who meet the physical requirements of the Navy, who are of thorough ability and officer-like character and who have completed the mechanical or electrical engineering course at certain recognized technical schools, or who possess an education and experience adjudged to be an equivalent thereof.

The course consists of five months of training divided as follows: One month of training at the Naval Training Camp, Pelham Bay Park, N. Y., one month of technical work at the U. S. Navy Steam Engineering School, Hoboken; two months practical training on board overseas transports and in shops in the vicinity of New York, and one month finishing course of instruction at the U. S. Navy Steam Engineering School.

Enrollment in the U. S. Naval Reserve Force of men properly qualified may be made at any navy enrolling office, notation being made of the applicant's qualifications and desire to be detailed to this school. Applicants will be enrolled as chief machinist mates, and during the course of instruction will draw the pay of this rating, $83 per month, plus $60 per month paid as subsistence. Upon graduation, men will be commissioned as ensigns in the U. S. Naval Reserve, with a salary of $1700 per year. The duty to which a graduate of this school will be assigned will be that of an engineer officer in the auxiliary service of the Navy.

Special provision has been made for the continuance of the school with proper material by a Navy regulation which permits undergraduates of the freshman, sophomore and junior classes in recognized engineering schools to enroll in the Naval Rerserve Force with the rating of seaman second class, and continue their courses at the institutions where they have matriculated. Such men will be called into active service after their graduation and can at that time, if they are qualified to pass an officers' physical examination, apply for admission to the U. S. Navy Steam Engineering School.

Men who are registered in the draft, either graduates or undergraduates, may enroll with the proper enrolling officer by securing from their draft board a letter of release which in all probability can be obtained for this purpose.

Men already in the naval service and properly qualified should apply for admission to the course to the commandant of the naval district in which they are staioned, via their commanding officer. They will be transferred to the school through a weekly quota from Naval districts, if their commanding officer considers them available for this special duty.

The aim of this school is not simply to produce engineers, but to produce naval engineering officers in the true sense of the word. The course of instruction covers a period of five months, which time is arranged in four periods.

The first period is spent at Pelham Bay Training Camp, New York. By means of drills and strict military discipline, the men are so trained that they understand both the value and the meaning of discipline. This period is from three to four weeks in duration.

The second period is spent at the Navy School in Hoboken, N. J. There, in five weeks, the man studies the characteristic construction of machinery used aboard ship. A week is spent on boilers, a week on propulsive machinery, two weeks on auxiliary machinery, and a week on operation. The week on operation is given so that the man may better utilize the training of the next period.

Lectures, quizzes and sketch periods occupy the day and the entire evening is spent in study. A drill period is also included in the afternoon.

The next period is called the applied period and is spent on board various classes of ships, such as tugs, ferry boats and sound steamers operating in New York Harbor and Long Island Sound. The final part of this practical training consists of a cruise overseas on a naval transport or cargo ship.

At this stage of training students are given the rank of warrant machinist (at a pay of $1500 per year) so that he can actually take charge of a steaming watch. The aim is to teach the operation of a marine plant, including adjustments and minor repairs such as are made aboard ship.

After the man has completed the applied course he is sent back to the barracks for further examination and study. It is felt that the future engineer officer must not only know how to operate a given type of equipment, such as may be found on a single ship, but must also be familiar with all standard machinery in use on other ships. He must also be resourceful enough to keep the plant in operation under all conditions.

At periods during the course the student visits boiler shops and engine shops and sees the actual construction of boilers and engines. Upon graduation the student is commissioned as an ensign, U. S. N. R. F., with a salary of $1700 per year, and is detailed for engineering duties on navy transports and cargo ships.

Further information can be secured by applying to the assistant to district enrolling officer, 102 Custom House Building, New Orleans, La.

LIMITATIONS UPON COAL STORAGE BY UTILITIES AND INDUSTRIAL PLANTS.

United States Fuel Administration Issues Order Specifying Number of Days' Bituminous Coal Supply Utilities and Industrial Plants May Store.

The tremendously increasing demand for coal for special war purposes in the Eastern part of the country, particularly for the Navy and transport service is making it necessary to draw more heavily on the Eastern coal fields than was originally contemplated.

In order to decide how best to secure this coal for these purposes with the least disturbance of the coal supply moving to other industries, a meeting of all State Fuel Administrators east of the Mississippi and also the States of Minnesota, North Dakota and South Dakota was held in Washington on Tuesday, August 20.

At this meeting it was decided that to accomplish the desired result it would be necessary to limit the amount of coal storage that industrial plants would be allowed to accumulate and to carry on hand and to fix a uniform amount for each State.

United States Fuel Administrator Garfield announced the basic policy of the Fuel Administration as to storage as follows:

"Coal in excess of that required for current operations shall be delivered to plants not on the preference list of the War Industries Board only when it is not in demand for use before April 1, 1919, by consumers on said list, namely, railroads, the Federal Government, States, counties, public utilities, retail dealers, or manufacturing plants on the preference list.

"In carrying out this policy, allowance shall be made for differences in distance from the mines and for differences in transportation conditions which may require more or less storage at the beginning of winter to insure uninterrupted operation until the following spring."

The following report, framed by a committee of State Fuel Administrators aided by officials of the Administration, was adopted by the conference, and concurred in by Dr. Garfield:

"The maximum limits of storage indicated for the several states or parts of states defined hereafter are:

MAXIMUM NUMBER DAYS STORAGE BITUMINOUS COAL ALLOWED UNTIL FURTHER NOTICE.

	Steam coal.			By-product and gas coal.		
	Public utilities.	Preferred Industries.	Non-preferred Industries.	By-product and gas plants.	Preferred Industries.	Non-preferred Industries.
Maine	120	90	30	120	90	0
Mass., Vt., N. H., Northern N. Y.	90	60	30	90	60	0
Conn., R. I.	75	45	20	75	45	0
Southern N. Y., N. J., Del., Eastern Pa.	30	30	15	45	30	0
Md., D. C., Va., N. C., S. C., Ga., Fla., Western Ohio	30	30	15	45	30	0
Western Pa., W. Va., Eastern Ky., Eastern Ohio	30	20	15	45	30	0
Lower Michigan	90	45	20	60	60	0
Ill., Ind., Mo.	..	..	..	60	60	0
Wis., Minn., N. D., S. D., Upper Michigan	..	..	..	90	90	0

"It is understood that these limits are mandatory and each Fuel Administrator is expected to see that the different classes of consumers are not allowed to exceed these limits. At the same time, it is understood that particular cases may require special treatment by a State Fuel Administrator, either by way of granting more stocks of coal than are indicated by these limits, or by restricting them to a less supply than indicated by these limits.

"Where a State Administrator decides that the maximum limit should be exceeded in a special case for some special reason, he shall have authority to grant a revocable increase in writing for a specific added number of days. The administrator shall report each such specific case in writing immediately to the United States Fuel Administration at Washington, which may in writing disapprove the extension granted by him. Otherwise, it shall stand subject to action of the State Fuel Administrator.

"Any company or concern which is permitted under the zoning regulations now or hereafter in force, to obtain coal from Illinois, Indiana, Western Kentucky, or from mines west of the Mississippi River may retain such reserve stock of coal as it shall have on the effective date hereof, on condition that such company or concern shall thereafter use screenings or mine run only, for its current necessities, and shall obtain such screenings or mine run for current use only from such last mentioned fields."

USE AND PRODUCTION OF ALUMINUM.

The ELECTRICAL REVIEW of August 3 contained an article on the aluminum production of the United States in which a typographical error appeared in that the statement was made that "the bulk of that now used in the industry is the product of the state of Kansas"; this should have read the "state of Arkansas."

Bauxite is used in the production of metallic aluminum and in the manufacture of aluminum salts, of bauxite bricks and of alundum. The use of bauxite in the production of metal aluminum is by far the most important one, and the largest part of the bauxite produced in Arkansas, as well as most of that imported, is used in the aluminum industry.

Alundum, which is used extensively as an abrasive, is made at Niagara Falls, N. Y., by fusing calcined bauxite in an electric furnace. Alundum is especially efficient for the grinding of steel forgings and castings. Only the best grades of bauxite are used in the manufacture of such chemicals as alum, aluminum sulphate, and aluminum salts, as freedom from oxide of iron is desirable for such purposes.

Another use to which bauxite is adapted is in the manufacture of calcium aluminate, which gives a quick set to plaster compositions.

The consumption of aluminum is constantly expanding, and aside from its use in the manufacture of cooking utensils, it is being employed in the construction of automobile castings and of welded tanks used by brewers, preserve manufacturers and fat renderers, and for wire for power transmission lines. Other uses which are important in their adaptability and efficiency, but which absorbs only a small portion of the domestic product, are the manufacture of powdered metal used as a paint pigment and in making aluminum foil. Aluminum foil is gradually displacing tin foil, which heretofore has been used for wrapping cheese, candies, tobacco, teas and other products.

ELECTRIC CLUB-JOVIAN ANNUAL OUTING

The annual outing of the Electric Club-Jovian League of Chicago was held at Ravinia Park on Thursday, August 22. The program was made up largely of field events, for which there were many valuable prizes. The affair was in charge of C. W. Pen Dell, chairman of the outing committee, who was assisted by a number of active subcommittees.

EMERGENCY POWER ACT INTRODUCED IN CONGRESS.

Bill Provides for Building or Taking Over Power Plants to Relieve Shortage.

A bill providing for National control of the country's power resources has been introduced in the House of Representatives by T. W. Sims, chairman of the House committee on interstate and foreign commerce. The bill carries an appropriation of $150,000 for administrative expenses and $200,000,000 for the purchase and building of power plants. Public hearings on the bill were begun on August 23. It is understood that the bill has the backing of the administration.

Among the important clauses of the bill are those empowering the President

1. To construct at any place or places within the boundaries of the United States such power plant or power plants as he may deem necessary, and in connection therewith to construct within such boundaries plants for the production of gas, coke, toluol, benzol, coal-tar products, and any other useful products that may be produced through or in connection with the coking of coal or lignite, or through or in connection with the combustion of any fuel.

2. For the purpose of increasing the capacity or productivity of any private power plant within the boundaries of the United States, to install in any such plant any structure, machinery or appliances that he may deem useful to that end, either through agents or contractors employed by him, or by providing the owner or operator of such plant with funds to be applied to that purpose; to lease the machinery, appliances and structures thus installed or any parts thereof to the owner or operator of such plant for a term of years not to exceed the war period and such reasonable time thereafter as he may deem expedient in the interest of the United States, upon such terms as he may deem reasonable, and to enter into contracts requiring or permitting the lessee to purchase such appliances, machinery and structures, or parts thereof, at or before the termination of such lease at their then value or upon such other terms as he may deem equitable for the protection of the interests of the United States and of the community served by such lessee. Whenever any such structures, machinery or appliances shall have been installed, and until the sale or other disposition thereof, the title thereto shall remain in the United States and shall be free and exempt from any liens, mortgages, judgments or other incumbrances, whether created by act of the owner or operator of such plant or by operation of law. And upon and during any default in any payment of any sums due the United States under such lease or contract the President shall be empowered at all times to enter upon the premises upon which such machinery, structures or appliances shall be installed and there to maintain and to operate them or any of them for the use of the United States free from any rent or other charge, or to take possession of and remove them or any of them from the premises.

3. To aid in equipping any private power plant or in expanding any such plant to such extent as he may direct by making advances, upon such terms and conditions as he may determine, to the person operating or authorized to operate it, and in connection with such advances to agree with such person that, if the actual reasonable cost of equipping or expanding such plant shall be in excess of its value at the termination of the war period, or at such later time not more than five years after the expiration of the war period as he may deem reasonable for such valuation, and the machinery, structures or appliances constituting such extension or expansion, or their equivalent, shall have been maintained and operated in accordance with his directions until such time, repayment of the whole or any part of such excess will be waived, and to provide by agreement for the manner of determining such costs and values by arbitration or otherwise and for the terms and time of such repayment; provided, that the powers conferred by this subdivision shall be exercised only if the President shall deem that the emergency is such as to render it impracticable or undesirable to act with respect to such plant under any of the other powers conferred by this act.

4. To acquire any private power plant within the boundaries of the United States.

5. To construct any pipe or other transmission lines, or other structures, facilities or appliances that he may deem necessary or useful for the purpose of better utilizing or of increasing the facilities of any power plant, or of combining the facilities or power of two or more such plants, or of better utilizing the gas, power or products generated by them.

6. To maintain, operate and extend any plant, pipe or other transmission line, or other structure, facility or appliance which he shall have constructed or acquired pursuant to the provisions of this act, and to deliver the power generated and the products produced in any such plant to such persons and in such proportions and at such times and at such rates as he may deem proper.

7. To require the operator of any private power plant within the boundaries of the United States to place at the disposal of the United States or to acquire from such operator during the war period the whole or any part of the power generated by such plant and during such period to transmit or distribute, or to require such operator to transmit or distribute, such power to any other power plant or to any other persons for such periods in such manner and quantities and upon such terms as he may direct.

8. To lease for the war period, or for such period thereafter not exceeding five years, or for any shorter period, and upon such terms as he may deem reasonable, to any person or body politic, for use in operation by such person or body politic, any plant, transmission line or other property or part thereof constructed or acquired pursuant to the provisions of this act.

9. In furtherance of any of the foregoing purposes, to modify, cancel or suspend any existing or future contracts for the delivery of power to any person not engaged in the production of war material, or to the extent to which he shall deem the power contracted for to be in excess of the requirements for the manufacture of war material by such persons or to which, in his opinion, it shall prevent the delivery of power which he shall deem necessary for the production of war material of greater or more immediate utility.

10. In furtherance of any of the foregoing purposes, to acquire any property or property rights, including any public or private rights, or any interest in any such rights; or any material, machinery, appliances or processes, patented or otherwise, which he may deem necessary or useful for the construction, development, expansion or operation of any such plant or transmission lines.

11. If in his judgment such action shall be necessary or useful for the purpose of this act, to form one or more corporations under the laws of any state, ter-

ritory, district or possession of the United States for the purchase, construction, extension, lease, maintenance or operation of any such power plants or facilities, or for the merger or consolidation of any private power plants, or for the purchase of the whole or any part of the capital stock thereof or of the property thereof; provided, that not less than the majority of the capital stock of any corporation thus formed shall be subscribed and during the war period shall be retained by the United States, and that at no time shall it be a minority stockholder therein.

12. To sell or exchange any plants or structures constructed by him and any property to which he shall have taken title, and any rights acquired by him, whenever in his opinion the interests of the United States will be furthered by such sale; provided, that no public right acquired by him shall be alienated for any term in excess of five years after the war period, upon any terms or conditions other than those prescribed by the sovereignty from which such public rights shall have been acquired; provided further, that whenever, in the opinion of the President, any structure or appliance which he shall have installed in any private power plant, or any structure or appliance in any such plant to which he shall have taken title, or any property or right which he shall have acquired from the owner of such plant, shall constitute an integral portion of such private plant, or shall be of such character that it would be uneconomical to separate it therefrom, the owner of such private power plant shall be accorded an option to purchase the same at the then reasonable value thereof, to be ascertained either by agreement or by arbitration, wherein the President shall select one arbitrator, the operator a second and the two thus selected a third, before the same shall be otherwise offered for sale or exchange. . . .

That whenever any act done pursuant to the provisions of this act shall constitute a taking of private property within the meaning of the Constitution, just compensation shall be made therefor in an amount to be determined by the President; and if the amount so determined by the President is unsatisfactory to the person entitled to receive the same, such person shall be paid 75 per cent of the amount so determined by the President and shall be entitled to sue the United States to recover such further sum as added to said 75 per cent will make up such amount as will be just compensation therefor, in the manner provided for by Section 24, paragraph 20, and Section 145 of the Judicial Code.

IRISH PEAT AND POWER SUPPLY.

At a recent meeting of the Institution of Electrical Engineers (Dublin Local Section), Major O. T. Webber, referring to the recommendations of the Coal Conservation sub-committee respecting electric power generation, said that the super-power station might be an excellent means of realizing the great wealth of the Irish peat deposits. G. M. Harris, of the Dublin United Tramways, said that by making cheap power available they would be able to increase their industries, raise wages and prevent their young men from leaving Ireland. Coal and water power were insufficient, but every means at command ought to be used and money spent, to develop the great peat resources. With proper machinery, he believed, they could provide peat which would be nearly as good and cheap as coal. Wm. T. Tomlinson said that across the center of Ireland there was peat equivalent to 3,200,000,000 tons of coal. L. J. Kettle, of the Dublin Corporation electricity department considered that Ireland had so few electricity systems that it was practically virgin soil, so that it would be far easier to carry out a comprehensive plan with a large central station and a number of smaller stations in Ireland than in any highly industrialized country. He asked for a national survey of the power resources of the country to be made.

DISABLED MEN BEING EMPLOYED FOR ENGLISH ELECTRICITY WORKS.

The British Government Department (the Home Office) which during the war has issued various orders permitting the employment of women in electric generating and substations, has announced that while it will not withdraw permissions so far given it will not grant any new orders of the kind unless it is satisfied that a bona fide attempt has been made to employ discharged soldiers and sailors. Organized effort is being made by the Home Office and the Ministry of Labor to secure work for large numbers of discharged men and electrical station work is considered specially suitable for them if they are carefully selected and suitably trained at one of the several schools and centers which have been established for such training. It is pointed out that the employment of women at night will in any case have to cease with the end of the war.

Though men can be adequately trained in a comparatively short period to do the routine work of an electrical station, electricity supply authorities are cautioned that such assistants must not, without a longer and more thorough training, be allowed to undertake such duties as cleaning of, or about live apparatus, that is, switchboards, etc., where technical knowledge or experience is required in order to avoid danger. They may, however, if necessary, be allowed to undertake the cleaning of the fronts only of medium-pressure switchboards of a simple character, provided: (1) that adequate instruction has been given; (2) that any necessary safety appliances (insulating gloves and goloshes) are used; (3) that such cleaning is not done when the person is unaccompanied.

ORDNANCE BOARD ON METALLURGICAL MATTERS.

In order to assure the more complete co-ordination of the various ordnance departmental activities along metallurgical lines, it has been decided to establish a Board on Metallurgical Matters. The appointment of this board will also assure the complete co-ordination of similar activities of the different divisions of the War Department and the War Industries Board.

The personnel of the board is as follows:

Dr. G. W. Sargent, Engineering Division, chairman.

Lt. Col. W. P. Barba, Production Division.

Major A. E. White, Inspection Division; representing the Ordnance Department.

Lt. Col. F. B. Richards, of the office of the Assistant Secretary of War.

L. L. Summers, representing the War Industries Board, and

William H. Smith, representing the manufacturers.

The board will act not only for the various sections of the Ordnance Department but also in connection with the manufacturers working for and with the department in the production of war material, and will gather the most recent and complete information on all metallurgical products.

Commercial

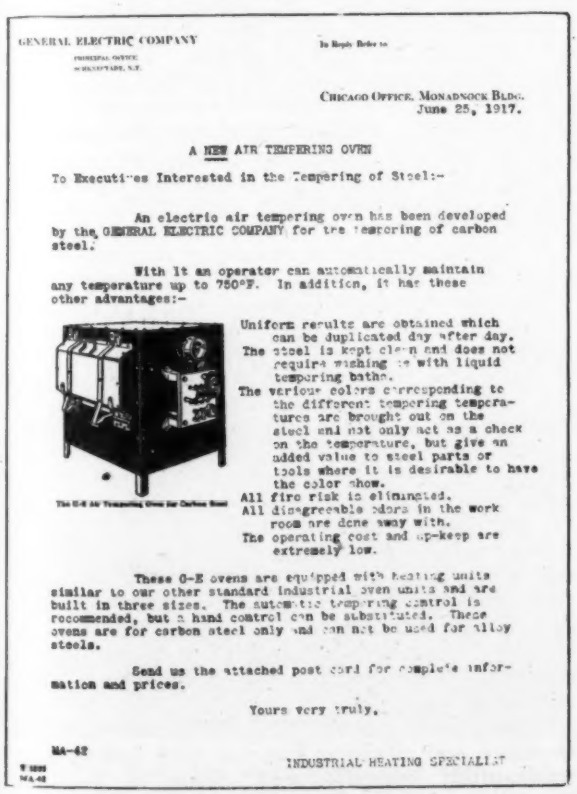
Helping the Industrial Heating Load—Efficiency Standards for Public Utilities—Locomotive Establishes Record

HELPING THE INDUSTRIAL HEATING LOAD.

Form of Advertising by Which the Manufacturer May Help the Central Station as Well as Himself.

In previous issues the ELECTRICAL REVIEW has told of the way in which the electric industrial heating load has been courted and fostered in Chicago, with the magnificent results already recorded. Publicity by the central station through the mails has been found one of the very best methods of reaching the propect, a method by which direct contact can be obtained.

The accompanying illustration shows a form of letter sent out by the General Electric Company in co-operation with the Commonwealth Edison Company, often receiving their cue from the central-station company as to a promising prospect. Anyone reading this letter, a bare statement of facts, if interested in



GENERAL ELECTRIC COMPANY

In Reply Refer to

CHICAGO OFFICE, MONADNOCK BLDG.
June 25, 1917.

A NEW AIR TEMPERING OVEN

To Executives Interested in the Tempering of Steel:-

An electric air tempering oven has been developed by the GENERAL ELECTRIC COMPANY for the tempering of carbon steel.

With it an operator can automatically maintain any temperature up to 750°F. In addition, it has these other advantages:-

Uniform results are obtained which can be duplicated day after day.
The steel is kept clean and does not require washing as with liquid tempering baths.
The various colors corresponding to the different tempering temperatures are brought out on the steel and not only act as a check on the temperature, but give an added value to steel parts or tools where it is desirable to have the color show.
All fire risk is eliminated.
All disagreeable odors in the work room are done away with.
The operating cost and up-keep are extremely low.

The G-E Air Tempering Oven for Carbon Steel

These G-E ovens are equipped with heating units similar to our other standard industrial oven units and are built in three sizes. The automatic tempering control is recommended, but a hand control can be substituted. These ovens are for carbon steel only and can not be used for alloy steels.

Send us the attached post card for complete information and prices.

Yours very truly,

MA-42

INDUSTRIAL HEATING SPECIALIST

MA-42

Form of Letter Sent Out to Prospects by the Manufacturer on the Initiative of the Utility.

this form of heating or the use of heating ovens in some industrial process, immediately has their interest aroused. It may be a vital need with them, perhaps a possibility of changing a difficult problem to a simple one, making the impossible an achievement.

By working together the local central station and electrical appliance manufacturer can accomplish far more than when working independently. Co-operation is richer of results, which means more load for the utility and greater appliance sales for the manufacturers.

METROPOLITAN COMPANY INCREASES RATES.

The Metropolitan Edison Company, Reading, Pa., has filed with the Public Service Commission at Harrisburg, revised schedules and rates, providing for an increase of 15 per cent in the charges for commercial lighting and power service, throughout the company's territory comprising Reading and Lebanon and their surroundings.

There is no change in charges for residence lighting. The increased power and commercial lighting rates are to become effective September 16, and will appear on bills rendered on and after October 16, next.

The company states that the proposed increase in rates is to help meet the increased prices of labor and materials, there being inserted a special clause whereby the rates will increase or decrease as the price of labor may increase or decrease.

This clause provides that for every one cent increase in the average scale of wages per hour, over the scale of wages in effect August 1, the commercial lighting and power rates shall be increased one-half of one per cent.

In like manner, for every one cent decrease in this average scale of wages, the rates shall be decreased one-half of one per cent, until the average wage per hour equals that in effect August 1, 1918. The increase or decrease in the hourly wage scale, is to be ascertained monthly and shall be the basis of fixing the increased or decreased sum to be paid for current during the next succeeding months.

RATE INCREASE GRANTED KANSAS CITY COMPANY.

The Kansas City Light & Power Company has been granted the privilege of increasing its rates 10 per cent "down the line" for all service in Kansas City. The Public Service Commission, which gave the order following hearings, is sending auditors and engineers to Kansas City to make a complete inquiry, and further readjustment will be made. The tentative increase is given for temporary relief, it being clear that the company must receive more revenue if service is to be maintained. The 10 per cent advance, effective September 1, will yield about $100,000 a year additional revenue. While costs are increasing for the company, however, revenue has not yet begun to grow radically—rather the opposite. The city council, for instance, has recently ordered that only two cluster lights be used in each block, a curtailment of 800 lights, and a cut annual revenue of the company of $20,000.

EFFICIENCY STANDARDS FOR PUBLIC UTILITIES.

Central Stations Should be Permitted to Enjoy Benefits From Efficient Management.

By M. G. Lloyd.

While efficiency standards are not of such immedite importance and concern to either customers or public as service and safety standards, they nevertheless are important elements in the general conduct of public utilities, and especially with reference to their effect upon rates under a régime of government regulation. Where utilities are left unregulated, efficiency is principally a matter of internal concern, and the desire to make a good financial showing will lead a competent management to properly care for this subject. Where regulation is by statute or by local ordinance, the same considerations apply, although the effort to curry favor with local authorities leads to the appointment of incompetent employes.

Under regulation by state commission the situation is entirely different. Rates are usually fixed by such commissions after a valuation of the property of the utility. It is aimed to adjust the total revenue of the utility so that after paying taxes and all operating expenses, and setting aside a reserve for depreciation, the remainder shall be just sufficient to provide a reasonable return upon the value of the property. Stated as a bald and rigid proposition, this ideal, if it could be practically attained, would remove the financial incentive to efficiency. The magnitude of the operating expenses would become a matter of indifference to the management, but of importance to the customers of the utility. It is evidently desirable that efficiency be recognized in some way in determining the profits of the utility owners. This may be achieved by choosing a rate of return in relation to the general efficiency of management and operation, so that this rate is dependent not only upon the risk involved in the investment, the prevailing rate of interest, or the rate necessary to induce further investments for extensions, but also upon the efficiency. This efficiency would naturally be judged by the ability to perform a given service in relation to the operating expenses incurred. But it involves more than that. It is concerned with the design and installation of the plant, since these will affect efficient operation. Efficiency can best be judged by comparison with other similar utilities, but this is not a sufficient criterion, since all may be efficient or all may be inefficient. Some standards of efficiency are sorely needed, but little has been done toward their establishment.

Efficiency Considered by Some Commissions.

The desirability of considering efficiency in regulating the rates of utility corporations has been specifically recognized in the utility laws of Arizona, California, Idaho and Pennsylvania. In these states owners of utilities are expressly empowered to participate, to such extent as approved by the commission, in the profits resulting from any economies or improvements which they may institute. These states and others as well, including Maryland, New York, Ohio, Utah and Wisconsin, recognize the propriety of a sliding scale of rates which automatically adjusts rates in relation to dividends paid to stockholders, so that one goes up when the other goes down and vice versa. In spite of the fact that such laws have been in existence for periods up to ten years, little application of the sliding scale has been made in the United States, although it has been extensively used in England. The best known example in this country is the scale applied to the Boston Consolidated Gas Company by act of the Massachusetts Legislature in 1906. This established 90 cents per thousand cubic feet as a basic price for gas and 7 per cent as a basic rate for dividends. For every cent reduction in price the company was permitted 0.2 per cent increase in dividends, and any profits not distributable as dividends were to go into a reserve fund, to be used for unforeseen contingencies or to meet dividends in lean years. If the reserve fund reached 5 per cent of the capitalization at any time, the change in rate was compulsory. Under this law the price was reduced within two years to 80 cents, the dividends going up to 9 per cent, and since then there has been no change. It is to be noted that this company was undercapitalized, that the Board of Gas and Electric Light Commissioners had supervision over the issue of additional stock and could place a selling value upon it, and that the relation between changes in price and dividends was such that savings in operating expenses were about equally divided between consumers and stockholders. With a constantly increasing output, however, the consumers receive an increasing proportion of the profits.

The law provided that after 10 years upon petition the standard or basic price might be changed by the Board. It was considered that 10 years would be long enough to give the method a test and determine its practicality, suitability and fairness. Unfortunately conditions developed which have destroyed its usefulness as a test for type of system. The Legislature directed the Board of Gas and Electric Light Commissioners in 1915 to investigate the operation and effect of the law, and the Board reported that the results have not been entirely satisfactory. The soundness of the principle at the basis of the sliding scale is recognized, but it is claimed that equally good results can be obtained by the more ordinary methods of regulation, and that the principle of rewarding economy and efficiency is actually carried out by the Board. It is pointed out that the expected operation of the scheme assumes that there is no means of distributing profits except through dividends, whereas actually the association of the company with others under the ownership of the Massachusetts Gas Companies affords such means. It is claimed also that the dividends paid were not actually earned, but obtained through the sale of property, and that inadequate provisions for depreciation have been made by the operators.

The Board concludes that the method has not had a fair trial and recommends that the Act be repealed unless the Boston Consolidated Gas Company is entirely dissociated from the Massachusetts Gas Companies. It is greatly to be regretted that the conditions in Boston were not such as to demonstrate conclusively the advantages and disadvantages of this method of regulation.

Recognition of the desirability of encouraging economy and efficiency has not been lacking among public-utility commissioners. Some of them have been supporting a policy which will reward good management by more liberal allowances of returns to investors. The Wisconsin Railroad Commission, which has been a pioneer in the inauguration of many progressive policies in connection with utility regulation, has disclosed a proper attitude upon this question in its eighth annual report. After calling attention to the fact that the electric central station is the only class of utility in the state whose operating expenses

decrease from year to year, the Commission has said as follows:

"These facts tend to show that the burden upon the Commission is to constantly promote efficiency in the way of granting a return to utilities which will induce them to place in operation modern appliances as they are put upon the market. Not only is this the case, but every effort must be made to show to the utilities the advantages and disadvantages of certain methods used in the production of the particular services which they sell. If this is not done, then the hope of future reductions in the price of these services will be by that much diminished."

This shows a realization by the commissioners that both knowledge and motive are necessary to achieve a desired result, which in this case is the reduction in the cost of electric service.

In certain contract ordinances it is provided that city and stockholders shall both share in surplus profits over and above a fixed return to the stockholders. Examples of this are the street railways in Chicago and Kansas City. This has an evident advantage over the Cleveland method of applying all surplus to the reduction of rates.

ELECTRIC MINE LOCOMOTIVE ESTABLISHES RECORD AT SCALP LEVEL.

Eighteen 100,000-pound capacity steel railroad cars, loaded in a single day, is the record output recently made by one motorman at Mine No. 1 of the Scalp Level Coal Mining Company, whose offices are at Windber, Pa. This mine is one of the John Lochrie operations and is situated in the famous Windber coal field.

On this particular day they worked exactly 9 hours and 45 minutes. The only haulage equipment used was an eight-ton Baldwin-Westinghouse electric mine locomotive, equipped with commutating-pole motors. This locomotive, except for a few mine cars hauled from a dip from a point in the heading by a mule, did all the work, gathering the coal cars and hauling them to the tipple. When they stopped work in the evening, the locomotive was inspected and found to be in first class condition, in spite of the heavy work it performed. The motors were nearly as cool as when they started in the morning. The cost of operating this locomotive for the day was: motorman, $3.30, and spragger $2.90, making in all $6.20.

Mine Locomotive Which Made Record Haul.

Twelve mine cars, each loaded with two tons of coal, were hauled on each trip. The longest haul was made about 2500 feet from the face of the first lift to tipple and about the same distance from face of main heading to tipple. The grades in this mine at two points for a distance of 400 feet are 1.5 per cent against the loads.

Thirty-six trips were hauled, and it is estimated that at least two minutes were lost on each trip on account of the motorman waiting for empty cars outside. Notwithstanding this loss of time the operators feel certain this was the highest run of coal ever made in Western Pennsylvania in one day by one motorman, and it is believed that it has never been equalled elsewhere.

The men at this mine claim that there was no extra effort made this day to make a record.

BUTTE WATER COMPANY'S NEW ELECTRIC PUMPING UNIT IN SERVICE.

A Motor-Driven, 5-Stage Centrifugal Delivers 6,000,000 Gallons Per Day—Original Units Held in Reserve.

An important electric pumping installation was made early this year by the Butte Water Company, which delivers the water supply to the city of Butte, Mont. The source of supply is the Big Hole River, 30 miles south of the city. The original project was completed 18 years ago. It consisted of a pumping plant on the river and a pipe line extending from there over the Rocky Mountain divide into the city. The pumping station, as originally built, contained a Snow high-duty converted steam pump, connected by rope drive to a Westinghouse 800-horsepower, 800-volt, induction motor; and a second converted steam pump, connected through herringbone gears to a General Electric 800-horsepower, 2200-volt induction motor. The water is forced from the pump station through a riveted steel pipe to a standpipe on the mountain summit, making a lift of 880 feet. It is carried thence by gravity through a 26-inch redwood-stave pipe to a supply reservoir, and then by gravity through a 22-mile line of 24-inch redwood pipe to the main distribution reservoir in Butte. The old pumping installation is maintained intact, but the actual service has been taken over by the new pumping unit.

New Electric Pumping Installation.

The new installation, which has been in service about ten weeks, comprises a Worthington 5-stage, centrifugal pump, with 12-inch single-suction, operating against a head of 875 feet, and has a rated capacity of 6,000,000 gallons per 24 hours. It is driven by a General Electric 1300-horsepower, induction motor, 2200 volts, 3 phase, 60 cycles, and is connected by direct coupling both to the 2-stage suction side and to the 3-stage discharge. The motor speed is 1180 revolutions per minute, and the pump has a rated efficiency of 88 per cent. The old pumping units are held in reserve for use in case of emergency. As in the case of all other electric service in Butte and vicinity, the power for this pumping plant is supplied from the Montana Power Company's system.

The water company's plans contemplate the laying of a new redwood pipe line, parallel to the line which has been in use 18 years, and to be supplementary thereto.

Operating

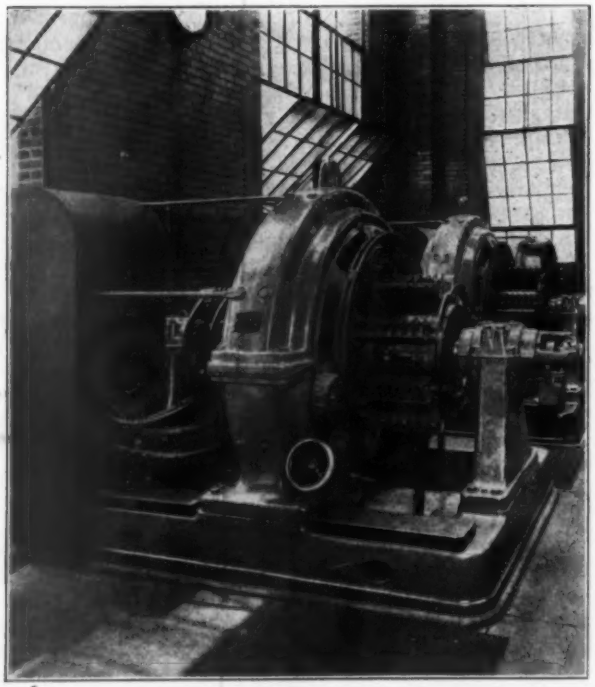
Safeguarding Converter Control—Boiler Performance and Stack Temperature—Dielectric Loss and Cable Failure

PROTECTION OF CONVERTER CONTROL.

Safety Measure Employed by Counties Gas & Electric Company.

The alternating-current supply to synchronous converters, between transformer and synchronous converter slip rings, has been a prolific source of trouble. The voltage applied to a synchronous converter, whether 250 or 600 volts, is so low, comparatively speaking, that the conductors have been left bare instead of being insulated, or at least unprotected; means have not been taken for protecting them such as would be taken with voltages of 1000 or higher.

One reason for leaving the conductors between transformers and converter slip rings uncovered has been that the voltage, 170 to about 380 volts, is low. Another is that the current at these low potentials is heavy, hence several conductors per phase have been



Synchronous Converter Installation, Counties Gas & Electric Company, Showing Thorough Protection of Switch Panel and Alternating-Current Leads.

employed to reduce inductance and skin effect, making it not altogether simple nor economical to amply protect these split conductors. Still another factor has been that for the larger synchronous converters; in fact, for anything from 100 kw. and above, six-phase is employed in preference to three-phase, because of the more economical design of machine and lower cost of the entire installation.

The illustration shows a method in vogue with the Counties Gas & Electric Company, Norristown, Pa., for protecting the alternating current control panels and leads of their synchronous converters. The control panel is installed as close as possible to the converter it controls. Each converter is seen to be a self-starter—that is, starts from the alternating-current side from two voltages below full line pressure. The massive bus work and the two sets of three-pole double-throw switches required for alternating-starting starting are protected by a very complete form of guard. In fact, the whole is entirely encased, enabling an operator to wipe the alternating-current rings of the converters in safety. The enclosure also serves to keep the conductors and buswork from being covered with dirt and dust.

It might be pointed out that even when a synchronous converter is nominally out of service, that is, is not running, the control or starting panel is alive unless the transformer supplying the converter has been cut out. Although the alternating-current potential of synchronous converters is not high, the conductivity of the conductors is high, and the capacity behind a short-circuit, should one occur, is also high, usually resulting in quite extensive damage.

Another safety feature noticeable in the accompanying illustration of a Counties Gas & Electric Company's station is the wooden treads on the base plate of the synchronous converter. These are heavy pieces of well varnished and seasoned wood, upon which an operator cannot help standing when touching the commutator, alternating-current leads or rings, etc. The use of wood instead of rubber mats, a common custom, has the advantage that wood will not wear, puncture, fall nor blow out of position as does rubber matting when used for this purpose. The protecting mat on the floor should also be noted, for it enables the operator to place one foot on the floor mat and the other on the wooden treads on the frame of the machine, while adjusting brushes, wiping commutator, etc.

BOILER EFFICIENCY AND STACK TEMPERATURES.

Chart and Formula Giving Change in Boiler Efficiency With Variation in Stack Temperature.

By W. F. Schaphorst.

If it is wished to determine the amount of fuel that can be saved by reducing the chimney gas temperature just zig-zag across this chart twice as indicated by the dotted lines.

For example, if the heat value of the fuel fired is 12,000 B.t.u. per pound, if the temperature of the flue gases before cleaning the flues or improving boiler conditions is 600 deg. F. and after improving the temperature is reduced to 500 deg., and if the overall or combined boiler efficiency before the improvement is 70 per cent, what is the fuel saving?

Run a straight line through the 12,000 and the 100

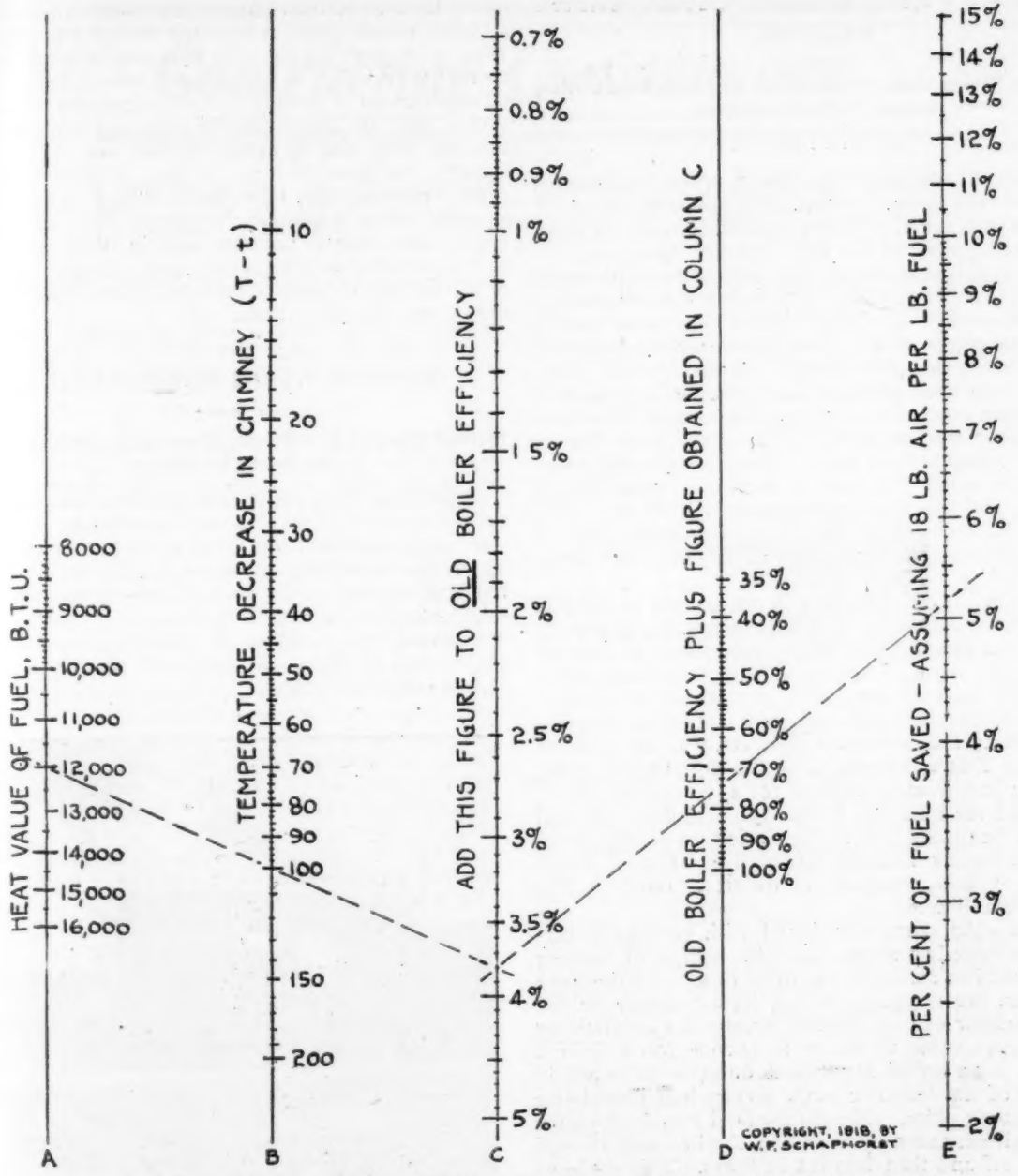


Chart for Determining Variation of Boiler Efficiencies With Changing Stack Temperature.

(600—500) and find the intersection with column C. The point of intersection in column C is 3.8 per cent. Along column C it will be noted these words are written, "Add this figure to OLD boiler efficiency." Adding we get

3.8 per cent + 70 per cent = 73.8 per cent.

Then simply run the second straight line through the 3.8 per cent in column C (already found) and the 73.8 per cent in column D and the final intersection with column E gives the *per cent of fuel saved* as 5.15 per cent. It is assumed throughout that 18 pounds of air are used per pound of fuel. The two dotted lines drawn across the chart indicate clearly how the above problem is solved.

Should it be preferable or necessary to solve problems of this kind by the formula instead of the chart, the formula upon which the chart is based, as follows, may be used:

$$\frac{100}{1 + \frac{EH}{457\,(T-t)}} = \text{per cent of fuel saved, assuming 18 pounds of air per pound of fuel.}$$

where E = the old combined boiler efficiency;
H = the heat value of the fuel;
T = temperature of the flue gases before improving;
t = temperature of flue gases after improving.

Substituting the above figures in the above formula, and checking with the values obtained by the chart, gives the following:

$$\frac{100}{\frac{70 \times 12{,}000}{457 \times 100} + 1} = \frac{100}{18.4 + 1} = \frac{100}{19.4} = 5.15 \text{ per cent.}$$

DIELECTRIC LOSSES CAUSE CABLE FAILURE.

Instance Where Dielectric Heating, Becoming Cumulative, Caused Cable Breakdown.

By C. P. Royce.

While the effect of high voltage upon the dielectric losses of underground cables, from the very nature of the problem, must be rather indefinite, cases do arise that forcibly remind one that dielectric losses may be the cause of breakdowns. One such instance occurred recently that brought this forcibly home to the writer.

Two very long 20,000-volt underground cables broke down repeatedly. The kilovolt-ampere load was not sufficient to cause overheating, far from it. The constants on these cables, a fact borne out by extended tests, were not such as to cause resonance, or surges and voltage rises along the cable. After many breakdowns it was noticed that a breakdown would occur only after a line had been in service a certain length of time, and this time was apparently little influenced by the kilovolt-ampere load carried. The length of time before breakdown would occur could be almost foretold.

Breakdowns did not occur in one section of the line any more frequently than in any other, dismissing the theory that local heating due characteristics of ambient soil was the cause of failure. The fact that time rather than load entered suggested that dielectric losses—dielectric resistance decreases with increasing temperature—which are cumulative in effect, was the cause of trouble. This was found to be the case, because after the line had been in service for a certain length of time, and the load was dropped so that only potential was on the conductors, the insulation would still puncture, indicating that the cumulative dielectric losses caused such a reduction in dielectric strength that puncture followed.

When the cause was found with reasonable certainty a remedy was also found. Instead of keeping the cable alive sufficient length of time for breakdown to occur, the company, basing its experience on the large number of past failures, arranged a schedule by which each cable would be in service for a definite period, a period of insufficient duration to result in heating of the dielectric to the point where cumulative heating took place. Directly the load was dropped the potential was taken off each line, the line was allowed to cool off and then was cut in again. This mode of operating reduced the number of breakdowns by about 75 per cent.

USE OF MEDIUM-HARD-DRAWN WIRE ADVOCATED.

At the recent convention of the Ohio Electric Light Association, Dr. M. G. Lloyd, in discussing specifications for transmission line overhead railroad crossings and the recommendations of the National Electric Safety Code in particular, made some pertinent remarks about the use of medium-hard-drawn wire.

The National Electric Safety Code recommends the use of medium-hard-drawn wire for transmission line railroad crossings. Said Dr. Lloyd:

"The use of that material is something that has not been given the consideration by utility engineers that it deserves. Medium-hard-drawn wire has some very decided advantages over the use of soft-drawn wire, especially in lines or spans where particular requirements have to be met. Medium-hard-drawn wire has a higher elastic limit; it does not stretch out so much when it becomes loaded with sleet and in wind storms as soft wire will. At the present time difficulty may be experienced in getting this wire from the manufacturers, who are pushed to the limit and want to turn out the thing that is easiest to turn out, and consequently, the least variety. It may be difficult to get even if ordered right now; but it is something to bear in mind when conditions have gone back to normal again, that there is an advantage in using that wire. It is worthwhile looking into it, and engineers will find it worthwhile to specify and purchase medium-hard-drawn wire for their lines."

RAISING WIRES TEMPORARILY.

Method Employed to Permit Electrically-operated Shovel to Swing Its Boom.

During some of the excavating made necessary for the prosecution of the Miami Conservatory project it was found that the presence of a number of overhead 2300-volt conductors, in service, would interfere with the performance of the shovels and at the same time might constitute a danger to the men in the shovel as well as to men working in proximity to the work should any of the conductors foul the boom of the shovel and fall to earth.

Method of Raising Conductors.

It was undesirable to re-rout the conductors on the score of cost, continuity of service and for the fact that such change in location would only have to be temporary. Under these circumstances it was decided to merely raise the conductors so as to permit the boom of the shovel to swing at its work of clearing away debris and dirt. This was done, as shown in the accompanying illustration, by making an extension to the poles, and mounting the crossarms upon it. The extension consisted of two pieces of 2-in. iron bolted to the pole to which the crossarms were in turn bolted through eyes obtained by bending the iron over at their ends, the eye being clamped between the double crossarm.

Contracting-Construction

Continuation of Discussion on Conduit Fishing with Practical Examples — Conductivity of Metal Raceways

A FEW FACTS ABOUT CONDUIT FISHING.

Removal of Obstructions From Conduit Before Fishing—Pneumatic, Percussion and Other Methods of Clearing Ducts.

By Terrell Croft.

[This is the second of seven articles by this well known author in which he describes and illustrates the best methods and equipment for fishing conduits. On account of the increasing use of interior conduit systems, this matter is becoming more and more important.]

Before Fishing Can Be Effected, Obstructions, If Any, Must Be Cleaned from the Interior of the Conduit.—It sometimes occurs, often in an inexplicable manner, that foreign matter finds its way into the interior of a conduit run. Gobs of plaster or cement thus lodged inside of the duct may cause a great deal of trouble. Especially while making installations in reinforced concrete buildings, where the conduit construction progresses with the concrete construction, these barriers inside of the tubes are likely to be encountered. Such difficulties may be minimized if the wiremen will close carefully the ends of the conduit runs when they leave the work. Special caps for sealing conduit ends are now available and are more reliable than wood or other makeshift plugs. But even if this practice is followed, such obstructions sometimes lodge. In remote instances they may be due to malice. Obviously, before a fish wire can be threaded through a tube, the obstruction must be cleared. The methods of clearing may be discussed under five general headings, thus:

(1) Manual clearing.
(2) Pneumatic clearing.
(3) Clearing by explosive percussion.
(4) Clearing by chemical action.
(5) Hydraulic-pressure clearing.

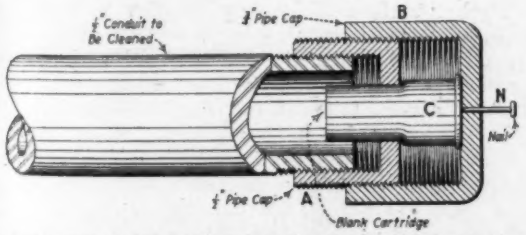


Fig. 2.—Ismond "Gun" for Shooting Obstructions From ½-Inch Conduit.

Each of these will be treated in subsequent paragraphs.

In the Manual Clearing of a Conduit Run to free it from obstructions a fish wire is inserted into the tube and pushed until its end butts against the obstruction. Then the wire is worked to and fro in an effort to discharge the obstacle. Where the particle stuck in the duct is comparatively small and does not adhere tightly, the manual method will be satisfactory. But in general it is not very effective.

In Clearing a Conduit With Compressed Air a force pump, which may be of the type illustrated in Fig. 1* (but which should preferably be of the design used by plumbers and gas fitters for forcing obstructions from pipes) is connected to one of the obstructed run and the pump is operated, thus creating a pressure against the obstacle which tends to dislodge it. With

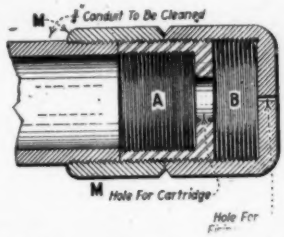


Fig. 3.—Gun for Shooting ¾-Inch Conduit.

pumps of the types used by plumbers it is possible to establish considerable pressure within the reservoir associated with the pump before the valve is opened that releases the pressure, thereby permitting it to impinge against the obstacle forcibly. A high pressure thus suddenly imposed is much more effective than a continued pressure of low intensity. While the pneumatic method is extremely effective in clearing ducts of small readily-detached particles, it may not remove firmly-attached obstacles.

In Clearing a Duct by Explosive Percussion a blank cartridge is discharged through the offending tube. This method was, so it is believed, first proposed by Edward Ismond, foreman of the F. E. Newberry Electric Company, and was described in Electrical Review for March 17, 1917, on page 456. Figs. 2 and 3 detail the "gun," which is attached to one end of the offending conduit, whereby the cartridge is discharged through the tube. This method appears to be particularly effective because the suddenly imposed impulse due to the explosion tends to break the bond between the obstruction and the walls of the tube. It has been found that for conduits of the smaller diameters where the length of run is short, a 0.22 caliber cartridge is ordinarily ample. For conduits of the larger diameters or where the conduit run is long, bigger cartridges up to possibly 0.44 caliber may be used. For ½-inch conduit the gun is arranged as shown in Fig. 2. The ½-inch pipe cap *A* has a hole drilled through it to accommodate the small-diameter portion of the cartridge *C* and it is threaded on the outside with a ¾-inch pipe die. A ¾-inch pipe cap *B* has a small hole drilled through its end through which a nail *N*, which is used for a firing pin, can pass.

To clean a ½-inch conduit with this gun, the device is assembled on the end of the tube as detailed in Fig. 2 with the cartridge in position. Then the nail-firing-

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*See Electrical Review, August 24, 1918, page 303.

pin *N* is struck a smart blow with a hammer which discharges the cartridge, the conduit serving as a barrel for the piece.

Where ¾-inch conduit is to be cleared, the same parts *A, B* and *N* (Fig. 2) used for the ½-inch duct are again utilized and in addition a ¾-inch coupling *M* (Fig. 3) must be arranged to attach the gun to the conduit end. So that the whole device may be assembled tightly, it is desirable to "square off" the edge of the faces of the caps *A* and *B*. This "squaring off" may, with careful workmanship, be done with a file, but should preferably be done with a lathe.

From a consideration of Figs. 2 and 3, methods whereby this gun may be adapted to conduits of diameters greater than ¾ inch will be obvious. Until the conduit is cleared by continued firing, the effect of each shot is dissipated largely by a discharge through the firing pin hole in the ¾-inch pipe cap. It is therefore imperative, in order to insure safety, that the workmen remain out of line with the pipe-cap-end of the gun when it is being fired.

The Performance of the Conduit Clearing Gun may be gaged from the following case which was reported by Mr. Ismond. In one installation a run of 300 feet of conduit having in it two 90-degree elbows was cleared with two shots. The first shot, which apparently loosened the principal obstruction, discharged portions of chips, cork, rag, and plaster. The second shot forced out a hunk of concrete which about half filled the tube.

Clearing Conduit Runs by Chemical Action is a method which is not to be generally recommended, although it has been used with apparently good results in certain instances. With this method, some acid solution which will dissolve or loosen the plaster or cement which has accumulated inside is forced into the conduit. Vinegar in one instance was used for this purpose and dissolved in twelve hours an obstruction which defied other methods. A solution of hydrochloric acid may also be used. The serious objection to this method is that the acid solution is likely to have some deleterious effect on the interior surfaces of the

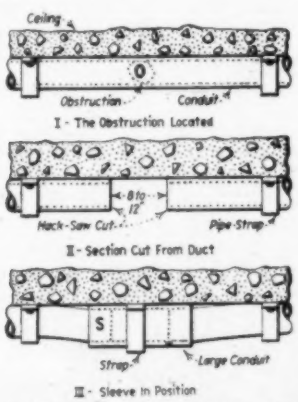


Fig. 4.—Method of Opening and Repairing Choked Duct to Remove Obstruction.

conduit, the extent of which it is difficult or impossible to ascertain.

The Hydraulic-Pressure Method of Clearing Conduit consists in forcing, with a suitable pump (for example, a hydraulic force pump like that used by plumbers or for gauge testing) water under pressure into the tube against the obstruction. By this means relatively enormous pressures can be exerted. It has occurred to the writer that it might be desirable, in certain instances, to force acidulated water into the tube so that the combined effects of hydraulic pressure and chemical action might be utilized. Like the foregoing, this method also has the objection that it tends to leave water inside of the duct which may subsequently cause trouble. However, practically all of this moisture may be driven out of the tube by forcing the water from it with a force pump and continuing the action of the pump until the interior of the tube becomes practically dry. To thus dry the tube, a vacuum cleaner may be employed to advantage, for either drawing or forcing a current of air through the duct.

When Conduit Interiors Become Clogged With Ice during the construction of a building, a steam hose can be connected to the end of the tube, whereby the ice is melted, or hot water can be forced in with a pump as suggested in the preceding paragraph. Where either of these methods is employed, the tube interior should, as already specified, be carefully dried with an air current to insure against future trouble.

In Cutting Into a Conduit Run to Remove an Obstruction the method suggested in Fig. 4 can, if the run is exposed, be followed. In sketch *I* the construction *O* is shown within the tube. Its location in the tube can be determined by inserting a fish wire from the nearest outlet to the obstruction, measuring the length of fish wire thus inserted and laying it off along the route of the run. After the point of obstruction has been thus located the tube is cut through, as shown at *II*, with a hack-saw for a distance of 4 to 6 inches on each side of the obstruction. Then this section of duct is taken out and it should contain the material which caused the clog. Now a sleeve *S*, which will fit snugly over the original duct, is cut, placed and secured in position at the point of the break, as shown at *III*.

(To be continued.)

ELECTRIC DRIVE IN MONTANA MINING DISTRICT.

Economy Mines Company, operating a mine in Mitchell gulch, 7 miles from East Helena, Mont., has installed electrical equipment, consisting of two 275-horsepower motors for driving two air compressors, and one similar motor gear-connected to a 400-gallon mine pump which is required to make a 300-foot lift. This company is building a concentrating mill at the mine which is to be operated by electric power. The Montana Power Company furnishes the electricity.

In the same locality the Montana-Chicago Mining Company is having a 4½-mile power line extended to its mine to enable it to use central-station power.

At Tostin, Montana, the ranchers are taking steps to develop a plan of pumping water for irrigating about 6000 acres of land. It is proposed to install a pumping plant on the Missouri River, from which a lift of 100 feet will be required to deliver water into irrigating ditches.

WIRING FOR STREET LIGHTING IN MONTANA COMPLETED.

Electric Supply & Engineering Company, Great Falls, Mont., recently completed the installation of a system of single-light street lighting at Conrad, Mont., the current for which will be supplied by Montana Power Company. The work included furnishing and setting 75 cast iron posts. The contract amounted to $8000. This company also wired the new Union High School brick building at Great Falls, and installed three service motors, the job amounting to $1500.

RELATIVE CONDUCTIVITY OF METAL RACEWAYS FOR WIRES.

The National Electrical Code requires that a metal raceway for electric wires be "permanently and effectually grounded" so that current from a short-circuit or ground may be carried safely to earth. The conductivity of the raceway is, therefore, an important factor.

The data here presented is considered to be of interest, but not necessarily complete or conclusive as affecting installation practice, or with reference to the safety of different types of wiring under practical conditions of service.

The chart shown on page 16 illustrates in a graphical manner the conductivity available in the steel of rigid conduit, armored cable, and metal moulding of the types now in common use, as compared with the conductivity of any one of the two or more copper conductors which may be used in such metal raceways; including, for rigid conduit, the largest single conductor permissible under the installation requirements of the National Electrical Code.

The steel is considered as having one-sixth the conductivity of copper, and all areas were reduced to square mils in figuring equivalents. The heavy line,

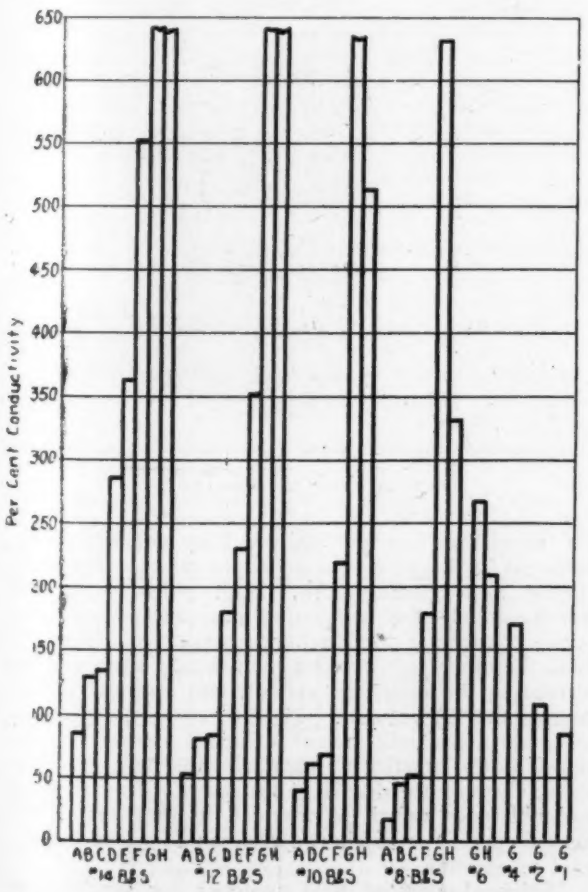


Chart Illustrating Conductivity of Steel of Rigid Conduit, Armored Cable and Metal Molding.

located at the 100 per cent level, indicates where the steel enclosure and the enclosed copper wire would have equal conductivities. This condition is closely approximated when No. 2 B. & S. or No. 1 B. & S. gauge wires are placed in ¾-inch conduit. Referring to the right side of the chart, it may be seen that with a No. 2 B. & S. gauge wire the conduit has a conductivity equivalent to 105 per cent; while, with a No. 1 B. & S. gauge wire, which is the largest single wire specified for use in ¾-in. conduit, the relative conductivity of the steel is 84 per cent.

Referring to the columns marked "D" for the backing member of metal moulding, it appears that with No. 12 B. & S. gauge wire, which is the largest size used in metal moulding, the metal affords approximately 180 per cent conductivity, compared to that of the copper wire.

The columns marked "B" and "C," at the left of the chart and illustrating double strip armors, are of nearly the same length and show an excess in conductivity in the armor as compared to No. 14 B. & S. gauge copper wire, but with a deficiency in conductivity when compared to No. 12 B. & S. gauge wire.

The columns "G" and "H," for rigid conduit, are not shown in their entirety for comparison with the smaller sizes of wire, owing to the extreme disproportion in values.

The case of armored cable or flexible steel conduit is of special interest as, aside from the computations charted, numerous tests have shown that when used to carry current, the circuit seems to tend to follow the turns of the armor rather than to pass from turn to turn, or from layer to layer of the armor.

The columns marked "F" assumes a solid walled tube without layers, or successive turns, and having a thickness equal to twice that of the strip of armored cable having the same internal diameter; they, therefore, represent a theoretical maximum conductivity for this material. The columns "A," "B," and "C" are based on the cross-sectional areas of the strips alone, assuming the strips to be straight. It should be understood that the whole chart is one of comparative areas, those of the steel being divided by six, for the purpose of direct comparison with copper.

AMONG THE CONTRACTORS.

Helena Electric Company, Helena, Mont., has the contract for wiring for light and power the new state laboratory building, amounting to $2000. Several motors will be required. The building and equipment will cost $40,000.

The State Supply Company, Helena, Mont., is wiring in conduit the new brick and concrete building of the Y. W. C. A. in that city. About 200 lighting outlets, 85 switches and 18 base receptacles are being provided. The wiring contract amounts to $2000. The fixtures to be installed will cost approximately $1700 additional.

Smith & Howley, 250 Wyoming avenue, Scranton, Pa., have been awarded the contract for the electrical work in connection with the new church to be erected on South Elmer avenue, Sayre, Pa., at a cost of $50,000. The company will also install the electric appliances, etc., in the new school to be erected at Throop, Pa., at a cost of $25,000.

I. Stark & Company, 346 Tompkins avenue, Brooklyn, N. Y., have been awarded the contract for the electrical work in connection with the new plant to be erected by Raebach & Zimptbaum at 16 Eckford street. The company has also secured the contract for the electrical work in connection with the new residence to be erected by Herman Gabbe at Westminster and Albemarle Roads.

New Appliances

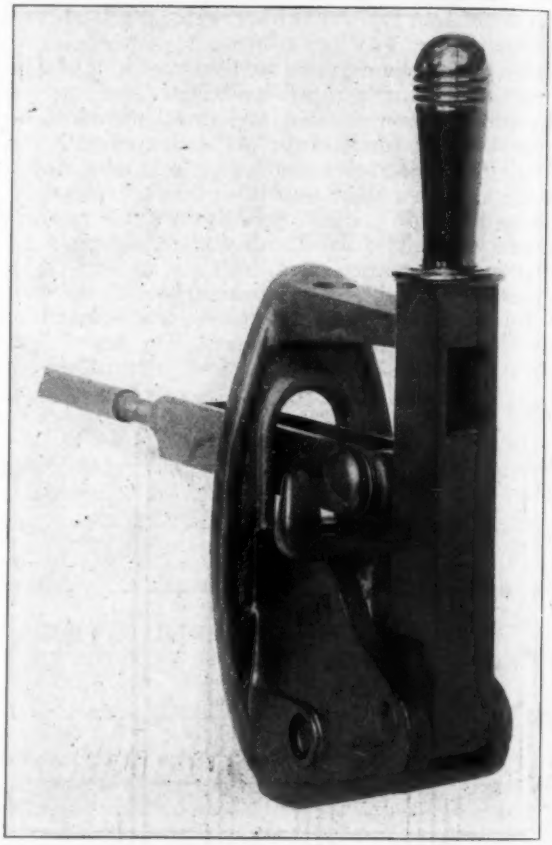
New Type of General Electric Field Switch — New Types of Westinghouse Relays — Electric Drive in a Textile Mill

BACK-OF-BOARD TYPE FIELD SWITCHES.

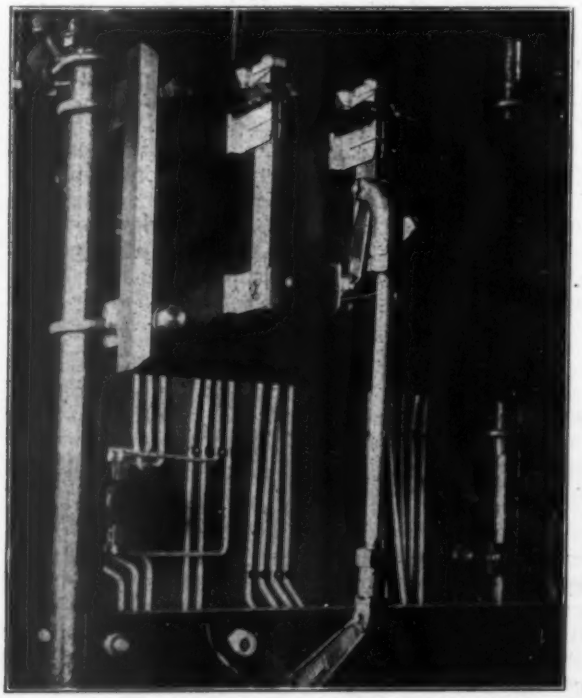
In the starting of a synchronous motor from an alternating-current source with the field open-circuited, which is the practice of the General Electric Company on all alternating-current motors using 125-volt excitation, there is considerable induced voltage across the field terminals until the motor reaches synchronous speed. Under these conditions an exposed field switch on the front of a switchboard is more or less of a source of danger to the operator.

The most approved method of reducing this danger in connection with hand-operated field switches is by means of the back-of-board switch shown. This switch embodies all the essential features from a safety-first viewpoint. It consists of an operating handle similar to an oil-circuit-breaker lever mounted on the front of the board and the switch proper mounted on a slate base, which is supported on a framework back of the switchboard. The switch is connected mechanically to the operating handle by means of connecting rods and bell hangers. This locates all live parts on the back of the board and does away with danger of accidental contact to the operator from the front. This type of switch is used also in connection with alternating-current generators when it is desired to reduce the risk from high induced potentials to a minimum.

When solenoid-operated field switches are used in the field circuits of synchronous motors started from the alternating-current source, they are ordinarily made of two single-pole elements with independent closing and opening coils. Both poles are closed simultaneously, but in opening, one pole precedes the other, connecting the discharge resistance across the field, the other pole opening immediately after and interrupting the discharge circuit, and entirely disconnecting the field circuit.



Operating Lever for Field Switch.



Field Discharge Lever Switch.

On synchronous motors utilizing 250-volt excitation it is the practice to start with the field short-circuited through the discharge resistance. In such cases a double-pole switch is provided to short-circuit the field through the discharge resistance during the period of starting.

Solenoid-operated field switches for synchronous motors started with the field short-circuited are double-pole with common closing coil and common opening coil. No provision is made for automatically interrupting the discharge circuit after the switch is opened, although the discharge blade can be opened by hand.

This switch is manufactured by the General Electric Company, Schenectady, N. Y.

NEW TYPES OF WESTINGHOUSE RELAYS.

New Transfer Relay.

Protective relays that operate by closing a separate direct-current tripping circuit which in turn trips the circuit-breaker, have proved more serviceable than "shunt-trip" relays and have come into very general use. In some cases, however, a separate direct-current tripping circuit is not available and other means must be sought. The use of "transfer" relays is the best solution so far obtained, for they energize the trip coil off the circuit-breaker through current transformers.

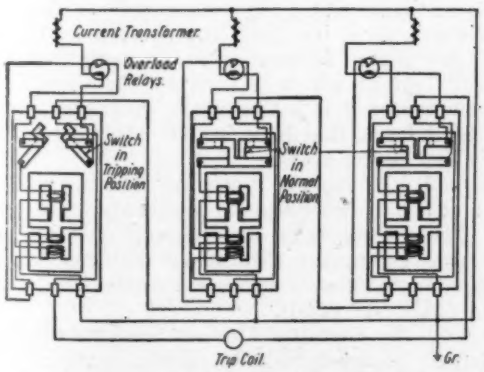
While designed particularly for use with the Westinghouse types CO and CR relays, the type BT relay can be applied to any make of circuit-closing relay of similar characteristics.

The breaker operates solely through the current transformer and the relays. When there is no fault on the line, the trip coil of the breaker is mechanically and electrically isolated from the circuit, avoiding possibility of tripping due to imperfection in the relay contacts ordinarily shunting the trip coil.

The relay which is manufactured by the Westinghouse Electric Manufacturing Company, East Pittsburgh, Pa., contains two series coils, an upper or operating coil and a lower or holding coil (see diagram of connections). The holding coil holds down the armature core, until a third coil, wound on the same magnetic circuit and known as the releasing coil, is short-circuited by the protective relay. The releasing coil acts as the secondary of a transformer and when short-circuited, a current flows through it, demagnetising the core. The holding coil, therefore, allows the operating coil to raise the core which operates the transfer switch, thus closing the trip coil circuit.

The transfer switch and other current-carrying parts of the relay are designed to carry 5 amperes continuously, but during times of short-circuit the switch may be called on to handle as much as 100 or 200 amperes.

A current transformer must be selected of sufficient capacity to operate the protective relay, the transfer relay, and the trip coil. Low-ratio bushing-type current transformers sometimes used on high-voltage circuit-breakers are not suitable.



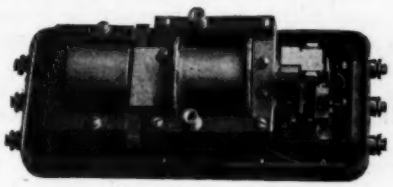
Note:- All Connections shown as viewed from Rear of Apparatus.

Diagram of Connections—Type BT Relay on Three-Phase Alternating-Current Circuit.

Only one trip coil is required for use on a polyphase circuit, but if the breaker is equipped with as many trip coils as there are relays, it is advisable to connect each trip coil to its corresponding relay.

Making Temperature Trip the Circuit-Breaker.

The oldest form of overload protection is electromagnetic, cutting off the current if it reaches a value deemed dangerous. The fact that most electrical apparatus can withstand momentary overloads without danger has gradually led operators to push up the current values at which electromagnetic protective devices will operate, or to dispense with them entirely, rather than undergo the inconvenience of having them disconnect the machinery on momentary peaks.



Westinghouse Type BT Relay, Cover Removed.

A method of visual protection on the basis of temperature was the next step. Exploring coils were built into the apparatus and used to indicate the temperature of hot spots by means of electrical instruments.

The latest step is a relay, the type CT, built by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., which automatically trips the circuit-breaker when the temperature reaches the danger point under excessive current. It may be used to protect any alternating-current apparatus from excessive heating if the apparatus is so arranged that exploring coils can be installed.

The relay is intended to protect apparatus against overheating from sustained overloads. To afford this protection with the least interruption of service the breaker should be tripped through the direct effect of the temperature of the apparatus. The relay should be so arranged that it prevents the breaker from tripping if the overload is of such short duration that the temperature does not rise to a dangerous value; while, if the overload persists the breaker must be tripped out as soon as the temperature rises beyond the critical value. This is accomplished in the type CT relay as follows:

Westinghouse Type CT Relay.

The type CT temperature relay operates on the Wheatstone bridge principle. Two arms of the bridge are copper exploring coils arranged to be placed in the oil or embedded in the windings of the apparatus to be protected, the other two arms are unchanging resistance mounted in the relay. The current for the bridge is supplied by the current transformer con-

nected in the circuit of the apparatus to be protected. The relay has two windings, corresponding to and co-operating to produce torque in a manner similar to the current and voltage coils of a wattmeter. The main winding is a coil operated directly by the current transformer. The auxiliary coils are connected to the Wheatstone bridge arms similarly to a galvanometer connection, and thus receive current, the magnitude and direction of which depends upon the resistance of the search coils. Above a certain temperature the torque of the relay is in the contact direction and below, in the opposite direction. It will thus be noted that in order to close the contact, two predetermined conditions must co-exist: excess current and excess temperature. Neither one will separately trip the relay.

The type CT relay is similar in construction to the Westinghouse type CO except that it has special windings, and two additional terminals.

The construction of the exploring coils will vary, depending on the kind of apparatus with which they are to be used.

MAKING UNIFORMS BY ELECTRICITY.

Interesting Installation of Up-to-Date Electrically-Operated Plant.

The making of khaki for our boys at the front is the industry of an enterprising textile concern known as the Stafford Springs Worsted Company. It is located among the foothills of Connecticut on the Middle river, a branch of the Willimantic.

The power for driving the entire mill and for lighting purposes is obtained from a 15-foot head in the Middle river. This is used to drive a Morgan-Smith water-wheel arranged for single or double drive.

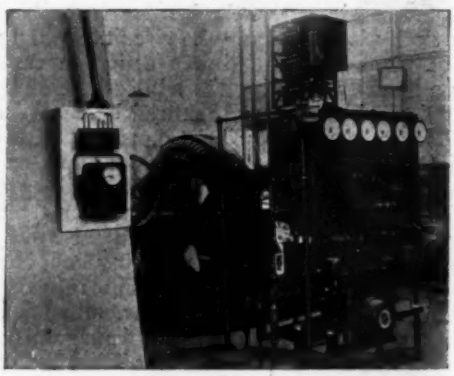
The wheel is direct-connected to a 175-kva., 600-volt, three-phase, 60-cycle Westinghouse generator. A three-panel switchboard with the proper equipment of instruments and switching devices controls the distribution of the electric energy to the various sections of the mill.

7.5-h.p., 1150-r.p.m. Motors Driving Cap Spinning Frames.

A pipe frame supports the panels, the field rheostat is mounted, as shown in the accompanying illustrations. One of the panels is for the control of the generator, and another for the two-feeder circuits to the mill, one of which is a 3-wire, 220-440-volt lighting circuit. The third panel is used to control the incoming line from the Rockwell-Willimantic Power Company, which service is used in case of low water, or at other times, when it is not advisable to operate the power plant. Three-phase power is brought to the mill at 22,000 volts and stepped down by means of three outdoor type Westinghouse transformers to 550 volts. The incoming line panel is equipped with a wattmeter and an ammeter. A demand meter is mounted on the wall nearby. An accurate account of power, received from the transmission company is obtained by the use of the three instruments.

A 750-gallon per minute centrifugal pump assures the fire protection throughout the plant. This pump is driven by a 75-horsepower type CS Westinghouse motor to which it is direct connected.

The power plant is located in a one-story brick structure immediately adjacent to the mill. It includes a boiler for furnishing steam to the mill for heating and drying purposes. An 80-foot custodis brick stack forms a part of its structure. The water is conveyed to the power house from the dam through a covered runway.



Plant of Stafford Springs Worsted Company. Generating Plant.

The company, though a new one, having been in operation only a little over a year, is one of the well established industries of the community. The number of employes is less than 100 persons. The average weekly output is 8000 to 10,000 pounds of yarn, practically all of which is used by the Government. The raw material is white when purchased, and to meet the demand that it be brown, about 75 per cent of it is sent to the dyers.

The mill is of modern type construction, two stories high, and it has dimensions approximately 160 by 210 feet. The management having realized the many advantages, equipped it throughout with electric drive. The equipment insured increased production and improved quality of goods.

Among the electrically driven equipment may be mentioned: two 35-horsepower motors mounted on the ceiling; one driving 32-30 spindle roving frames and the other four sets of drawing frames. There are also 24 spinning frames, each driven by 7½ horsepower motor, 12 twister with 200 spindles each driven by a 7.5 horsepower motor, and 16 Jack spools all driven from a ceiling mounted 7.5 horsepower motor. An elevator and 14 humidifiers are also included in the electrically-driven equipment of this comparatively small but extremely modern and complete plant.

The complete electrical equipment was furnished by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

RUTLAND, VT.—The Rutland Railway, Light & Power Company has contracted with the Rutland Railroad Company for supplying additional power to the amount of about 500 horsepower for the operation of the new shops now in course of construction.

DANA, MASS.—A committee has been appointed to secure electric lighting for the village. Address Rolin D. Doubleday, town clerk.

PROVIDENCE, R. I.—Queen Dyeing Company has recently commenced the construction of a new boiler plant addition at its works on Valley Street, about 80x80 feet, to cost $25,000. The M. A. Gammino Construction Company, Grosvenor Building, Providence, is the contractor.

GREENWICH, CONN.—To provide additional water supply for power plant service at its Cos Cob works, the New York, New Haven & Hartford Railroad Company has acquired approximately eighteen acres of land along the west bank of the Mianus River.

NEW LONDON, CONN.—The United States Government, Bureau of Yards & Docks, has awarded a contract to the R. R. Bill Company, Springfield, Mass., for the construction of a new boiler plant and the installation of a heating system at the local naval station.

PLAINVILLE, CONN.—Announcement has been made by the Trumbulll Electric Manufacturing Company that it has discontinued permanently the manufacture of Armored cable, armored cord, and flexible steel conduit, schedules "X" and "Y," in order to devote its entire plant to the production of its other specialties.

BORDER CITY, N. Y.—The plant of the Empire Gas & Electric Company was damaged by fire. The loss is $30,000. Carl Brunt, general manager.

BROOKLYN, N. Y.—The United States Government, Bureau of Yards & Docks, has taken bids for the installation of a new electric light and power system at the local navy yards. The work is estimated to cost $20,000.

BUFFALO, N. Y. — Pierce-Arrow Motor Car Company has awarded a contract to Stone & Webster, Boston, Mass., for the construction of the proposed new power plant addition to its works at North Elmwood avenue and the New York Central Railroad. The structure will cost approximately $300,000.

BUFFALO, N. Y. — Worthington Pump & Machinery Corporation, Clinton and Robert streets, has taken bids for the construction of a new transformer house at its plant, about 20x70 feet. The structure is estimated to cost about $6000.

ELLIS ISLAND, N. Y.—The United States Government, Department of Immigration, has awarded a contract to Almirall & Company, 1 Dominick street, New York, for improvements in the main power plant at the local hospital.

GENEVA, N. Y.—The city has had plans prepared for the construction of a new one-story boiler plant, about 40x48 feet, the structure being estimated to cost about $15,000. J. W. Brennan is city engineer.

GENEVA, N. Y.—New York Telephone Company, 15 Dey street, New York, has had plans prepared for alterations and improvements in its local exchange building.

HORNELL, N. Y.—New York Telephone Company, 15 Dey street, New York, has awarded a contract for the construction of a new two-story brick addition to its local telephone building, to cost about $10,000. Lee Dennison, 162 North Main street, Hornell, is the contractor.

PHOENIX, N. Y. — In connection with the construction of the proposed new silk mill to be erected by John Dunlop's Sons Company, plans are being prepared for the construction of a large hydroelectric plant for the operation of the mill.

SYRACUSE, N. Y.—The municipal lighting commission has tendered a report to the mayor recommending the rejection of the bid of the Syracuse Lighting Company for additional street lights. It is understood that the movement is one to encourage the construction of a municipal lighting plant. The lighting company has recently announced that the daylight saving order of the Government has reduced its revenues about $25,000 and that a like amount has been lost through the action of the fuel administration in ordering reduced lighting. It is understood that the price asked by the company for street lights aggregates ten cents a night per post.

SYRACUSE, N. Y.—In connection with the reorganization of the Syracuse & Suburban Railroad Company, it is planned to make extensive improvements in the plant and system. John J. Stanley, Cleveland, O., has been elected president.

TONAWANDA, N. Y. — Republic Light, Heat & Power Company has absorbed the Tonawanda Light, Heat & Power Company, which at present furnishes gas to Kenmore and Tonawanda.

TOTTENVILLE, L. I., N. Y.—The Richmond Light & Railroad Company has been ordered by the Public Service Commission to make extensive improvements in its shops, etc., and overhaul its rolling stock, to provide for increased operations.

WATERTOWN, N. Y.—The city is having preliminary plans prepared for the construction of a new municipal electric plant, to cost, it is understood, in excess of $200,000. Thomas L. Tomlines, City Bank Building, is architect and engineer.

AMPERE, N. J. — The Crocker-Wheeler Company, manufacturer of generators, motors, etc., has had plans prepared for the erection of a new addition to its plant near Fourth avenue. The company has taken out a building permit for the structure.

BARRINGTON, N. J.—The Borough Council has passed an ordinance granting permission to the Delaware & Atlantic Telegraph & Telephone Company, to construct the necessary poles, install electric conduits, etc., in the main thoroughfares of the borough. Walter B. Manlove, Borough Clerk.

CAMDEN, N. J.—In connection with extensive improvements at the plant of the new York Shipbuilding Corporation, negotiations have been completed between the Public Service Corporation and the Emergency Fleet Corporation for the immediate construction of the proposed extension in the traction system on Warren street, to provide increased transportation facilities for workers engaged at the plant of the New York corporation. The proposed work is estimated to cost $219,947.

NEWARK, N. J.—Schaedel & Brothers Company, Bruce street and Thirteenth avenue, has had plans prepared for improvements and alterations in its power plant.

PERTH AMBOY, N. J.—The City Council has approved plans for the installation of new meters and other equipment at the municipal power system. Jay Frank is city electrician.

POMPTON LAKES, N. J.—In connection with the construction of the proposed new addition to the municipal hydroelectric plant, bids for which were recently received, the Borough Council has awarded contracts for the installation of new equipment as follows: the Hydraulic Turbine Company, Camden, N. Y., for turbines, at $7065; and the Watson-Flagg Engineering Company, 120 Liberty street, New York, for generators, switchboards, etc., at $11,282.

TRENTON, N. J.—The American Steel & Wire Company has had plans prepared for the erection of a new one-story brick and concrete pumping plant at its works. A building permit for the structure has been taken out.

TRENTON, N. J.—Rapid progress is being made by the Philadelphia & Reading Railroad Company, Reading Terminal, Philadelphia, on the erection of the new one-story battery building, about 20x30 feet, at Trenton Junction. The structure, when completed, will cost about $10,000.

TRENTON, N. J.—Work has recently been completed on the installation of a new electric light system on the

bridge across the Delaware River between Trenton and Morrisville.

WOODBRIDGE, N. J.—In connection with the recent orders of the Fuel Administration regarding the reductions in electric lighting systems, the Borough has issued orders to the Publec Service Electric Corporation to remove a number of lights in the following streets: Ridgedale avenue, Rahway avenue, Campton avenue, George's road, Upper Main street, Main street, Madison avenue, Grove street, Sutton street, Fulton street, Albert street, Coley street, Second street, Pearl street, Green street, James street, School street, Linden street, Freeman street and Metuchen avenue. F. F. Anness is local fuel administrator.

BETHLEHEM, PA.—The Philadelphia & Reading Railway Company has awarded a contract to the Roydhouse-Arey Company, 112 North Broad street, Philadelphia, for the construction of the proposed new one-story brick and reinforced concrete engine house and power plant, about 35 by 75 feet and 100 by 200 feet, respectively, to be located on Saucon Creek.

PHILADELPHIA, PA.—John Greenwood & Son, Emerald and Huntingdon avenue, have had plans prepared for alterations and improvements in its one-story brick boiler plant. Contract for the work has been awarded to George Kennington, 2435 North Hope street, Philadelphia.

PHILADELPHIA, PA.—The Philadelphia Electric Company is making rapid progress in the construction of the large new power plant near Chester, to have a capacity of 120,000 k.w. It is proposed to supply this power to the plant of the American International Corporation at Hog Island. It is said that the company is considering plans for the erection of additional power plants to furnish service for the operation of the various plants engaged on war work in this vicinity.

PHILADELPHIA, PA.—Rapid progress is being made by the Bell Telephone Company on the extensive alterations and improvements in its telephone building on West Chelton avenue, and it is expected that the work will be completed at an early date.

PHILADELPHIA, PA.——Schwarz Wheel Company, Margaret street and Trenton avenue, has awarded a contract for the construction of a new one-story brick addition to its engine plant, about 30 by 80 feet. The structure will cost about $10,000. E. M. Sax, Franklin Bank Building, is the contractor.

PITTSBURGH, PA.—West Penn. Power Company has just concluded an arrangement with the War Department for the construction of a $5,000,000 power plant to supply the Pittsburgh district. The plant will be located at the mouth of the coal mine in the Allegheny Valley, and will develop 40,000 k.w. The Ordnance Department will advance $2,000,000 to the company while private bankers will furnish the remaining $3,000,000. The cost is to include the construction of a transmission line to the Pittsburgh district.

STEELTON, PA.—The Bethlehem Steel Company is planning to commence work at an early date on the installation of a large new turbine in its power plant near Locust street.

WASHINGTON, D. C.—The Potomac Electric Power Company is considering a bond issue for $2,100,000, to provide for extensions and improvements in its plants and system.

WASHINGTON, D. C. — Potomac Electric Light & Power Company is making a strenuous effort to meet the demand for electric current for lighting and power, not only for the immediate future but for 1919, when the urgency of service demands will be greatly increased. With part of the proceeds of the $2,100,000 bond issue recently authorized, the corporation has purchased and will shortly place in operation a new 15,000 kilowatt unit.

RICHMOND, VA.—The Chesapeake & Ohio Railroad Company is planning for immediate work on the construction of the proposed new additions to its local plant. In connection with the work a new power house for operation will be erected.

RICHMOND, VA.—The city has had plans prepared for the installation of new equipment at the municipal power plant to provide for increased operations. An appropriation of $12,000 has been made for the work.

SEVEN PINES, PA.—War Department will expend $3,000,000 for sidewalks, water works, electric light plant, etc., for an industrial city of 5000 to 7000 population.

FAIRMONT, W. VA.—The Monongahela Valley Traction Company is planning for extensive additions to its electric power plant at Rivesville. A new gas producer plant will also be erected.

DATES AHEAD.

Association of Iron and Steel Electrical Engineers. Annual convention, Southern Hotel, Baltimore, Md., September 9-14. Secretary, John F. Kelly, McKeesport, Pa.

Northwest Electric Light and Power Association; affiliated with N. E. L. A. Annual convention, September 11, 1918. Secretary, George L. Myers, Pacific Power & Light Company, Portland, Ore.

Michigan Section, N. E. L. A. Annual convention, Pantlind Hotel, Grand Rapids, Mich., September 17 and 18. Secretary-treasurer, Herbert Silvester, Monroe, Mich.

International Association of Municipal electricians. Annual convention, Atlanta, Ga., September 24-27. Clarence R. George, Houston, Tex.

New England Section of the National Electric Light Association. Annual meeting, Hotel Kimball, Springfield, Mass., September 27 and 28. Secretary, Miss O. A. Bursiel, Boston, Mass.

American Electrochemical Society. Fall meeting, Princeton, N. J. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa.

American Electric Railway Association. Annual meeting, Atlantic City, N. J., October 8 and 9. Secretary, E. B. Burritt, 8 West 40th street, New York City.

Illuminating Engineering Society. Annual convention, New York City, October 10. General secretary, Clarence L. Law, Irving place and 15th street, New York, N. Y.

Jovian Order. Annual convention, Dallas, Texas, October 24-25-26. Mercury, Eli C. Bennett, 1415 Syndicate Trust building, St. Louis, Mo.

Kansas Public Service Association. Annual meeting, Kansas City, Kans., October 17-19. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kans.

HUNTINGTON, W. VA.—The Columbia Gas & Electric Company has received a contract from the Government for furnishing electric energy for the new federal nitrate plant to be located at Broadwell, near Cincinnati, Ohio. The contract provides for an increase in capacity of the company's electric plant, including a new 30,000 k.w. turbo generator, condensers, boilers, and auxiliary equipment. The company is to be in position not later than July 1, 1919 to furnish a minimum of not less than 30,000 kilowatts per month and up to 40,000 kilowatts. It is understood that the Government has advanced the company $2,000,000 for the work.

MARSHALLVILLE, GA.—Application has been made for incorporation of Big Indian Power Company to generate electricity for manufacturing and lighting purposes; capital stock $30,000. H. A. Murph, J. J. Murph and F. M. Mulline, incorporators.

MONTICELLO, FLA.—$17,500 in bonds have been voted for purchasing electric light plant.

TALLAHASSEE, FLA.—The management of the Leon Hotel Company will construct a private electric plant.

TAMPA, FLA.—War Department, Washington, D. C., contemplates the erection of a plant to manufacture phosphorus for screening ship and troop movements during the war, for which 26,000 kilowatts of electric power will be required. Major W. G. Lockwood is investigating a site for the plant.

WAUCHULA, FLA. — $24,000 in bonds have been voted to purchase electric light plant. Address Lewis Carlton, chairman of the board of trustees.

NORTH CENTRAL STATES.

AKRON, OHIO.—An ordinance has been introduced in the city council calling for the expansion of the white-way section. Arc lamps installed on ornamental posts are proposed.

BLOOMFIELD, IND.—The Bloomfield Power & Water Company has filed a petition with the Indiana Public Service Commission asking authority to issue $500,000 of preferred stock to refund indebtedness incurred in buying and holding companies, which the larger company operates and to refund money spent for equipment and improvements.

HAMMOND, IND.—The Hammond, Whiting & East Chicago Railway Company has filed a petition with the Indiana Public Service Commission asking authority to increase its fares in Hammond, East Chicago, and Whiting to seven cents and to establish a two and one-half fare for school children.

INDIANAPOLIS, IND.—An early unification of the telephone systems in Indianapolis and in other parts of the state seems to be in prospect as the result of a series of conferences between the Bell and the Independent interests. The unification of the Indianapolis system will be the hardest problem but it is believed it can be solved with reasonable time, as it has been seriously studied and planned for some time. The fact that the Indianapolis Telephone Company has automatic telephones in use will not stand seriously in the way of the merger, although there is a technical problem connected

with the automatic service. It is estimated that long-distance telephones leading out of Indianapolis could be united in about three months and the local telephones could be unified shortly afterwards.

CHAMPAIGN, ILL.—Two towns in this vicinity, Mahomet and Sadorus, are taking steps toward the installation of electric lights. Both will probably be supplied from the Illinois Traction System, Mahomet lying north and Sadorus south of the Bondville substation of the traction company.

WAUKEGAN, ILL.—Louis P. Erskine, fuel administrator of Lake County, Ill., has named a conservation committee to look into the conservation of power and light. This committee will have the authority to refuse either power or light to a store or industry when it is felt that the use of such power and light is not to the best interests of conservation.

WEST FRANKFORT, ILL.—Mines Nos. 18 and 19 of the Peabody Coal Company will be equipped with individual electrical units. At Mine No. 19 a 450-k.w. generator is to be installed and same connected with a Corliss engine. The new boilers are to be installed at this mine. A similar or possibly a larger generator will be installed at Mine No. 18 than is installed at Mine No. 19.

ESCANABA, MICH.—The Council will extend the lighting district on Four River Road. Address City Clerk.

KEOKUK, IOWA.—Live Wire Supply Company has been awarded the contract by the Western Illinois Utilities Company to build a transmission line from the Keokuk dam. The contract also includes substation and distributions in all the towns. Address contractors, care Mississippi River Power Company, Keokuk.

MUSCATINE, IOWA. — Farmers' Electric Line recently incorporated in Cleona township and will build a pole line to carry two wires of 4000 voltage. The electricity will be supplied by the Muscatine Lighting Company. Address F. S. Dewey, general manager.

APPLETON CITY, MO.—The election voting $15,000 bonds for electrical improvements carried. W. B. Rollins & Company, 209 Railway Exchange, Kansas City, Mo., engineers.

HARRISONVILLE, MO.—An election will be held immediately to vote on the proposition of the Green Light & Power Company to lease the Harrisonville municipal electric light plant for a period of ten years.

KANSAS CITY, MO.—Kansas City Light & Power Company is unable to secure steel for completing the setting for the turbines of its new power house, and the station may not get into service until next year. One turbine is on the ground. The company will proceed with such work as can be done, pending the arrival of steel. The foundations for the building and most of the equipment is completed, the boilers are being set, and the concrete forms removed.

NOVINGER, MO.—The Merchants Light & Power Company is considering plans for the reconstruction of its electric plant recently destroyed by fire.

SIKESTON, MO.—Missouri Public Utilities Company presented a petition for increased electric light rates to the State Public Service Commission. The data has been presented to the city and a decision will be reached shortly.

BUFFALO, KANS.—On September 5 an election will be held to decide the question of issuing $20,000 electric light bonds. Address Arthur Pickett, city clerk.

AGENDA, KANS.—Concordia Electric Light Company has just installed a system of electric lights in Agenda and it is also preparing to connect with the town of Cuba further west.

GLEN ELDER, KANS.—The electric light plant at Glen Elder recently burned down.

HARDTNER, KANS.—O. K. Light & Power Company has been incorporated with a capital stock of $25,000 by J. H. Hudson, Capron, Kans., and G. B. Darling, and I. C. Vaniman, Hardtner.

KIRWIN, KANS.—Notice has been received recently by the mayor of Kirwin from the State Utilities Board stating that an increase in rate for electric current had been granted the Solomon Valley Electric Light & Power Company. The rate will not become effective, however, until the board is satisfied that the plant has been put in condition to render adequate and efficient service.

RANDOLPH, KANS.—Connections have been made with the Rocky Ford Light & Power Company, four miles north of Manhattan, Kans., and Randolph is now furnished with electricity.

SCRANTON, KANS.—Representatives from the city council of Scranton attended a meeting of the Burlingame council in an attempt to secure light and power, recently. The discusion brought out the fact that already the city of Burlingame is using 65 per cent of its maximum current and it would not be practicable to attempt to supply Scranton. Smaller plants in other neighboring cities will therefore be inspected with a view to securing service.

NEBRASKA CITY, NEBR.—The Lincoln Telephone & Telegraph Company has purchased a site for the erection of telephone building. Address local manager.

SOUTH CENTRAL STATES.

ASHDOWN, ARK.—The Consolidated Public Service Company is considering plans for the installation of new equipment at its plant, including new generators, etc., to provide for increased operations.

MENA, ARK.—An agreement has been reached between the city and the Commonwealth Public Service Company which recently purchased the electric light and ice plant, for a 20-year franchise. The company is to spend $25,000 repairing and enlarging its plant and when the alterations are completed 24 hour service will be furnished. Until that time 20-hour service is to be given.

SPARKMAN, ARK.—The Sparkman electric light plant, owned by Edward Hearn, was destroyed by fire recently.

DUNCAN, OKLA.—Election will be held September 2, on $30,000 light plant bonds and also on $50,000 for sewer extensions and $50,000 for water works. Benham Engineering Company, Oklahoma City, Okla., engineers.

WAURIKA, OKLA. — Contractors are making preliminary arrangements for the construction of an electric light plant.

ATLANTA, TEX. — The Atlanta Light & Ice Company will soon commence work on the reconstruction of its electric plant and ice factory recently destroyed by fire with loss estimated at about $70,000.

EL PASO, TEX.—Rio Grand Valley Traction Company will increase its capital stock from $300,000 to $500,000. Extensions will be made.

GALVESTON, TEX. — The Navy Department will construct an electric lighting system for a $2,000,000 airplane training base. L. B. Hyde, U. S. N. Engineer.

DALLAS, TEX. — Dallas Light & Power Company has been authorized by the city commission to purchase 2000 20 inch reflector fixtures to improve the city's light facilities.

LUBBOCK, TEX.—The city will construct a $35,000 electric light and power plant.

SOMERVILLE, TEX.—Plans are under consideration by the Gulf, Colorado & Santa Fe Railway for the construction of a new local electric power plant.

WESTERN STATES.

SEATTLE, WASH.—A movement is on foot by city officials to connect the city lines with those of the Puget Sound Traction, Light & Power Company in order that the city may use the surplus power in filling contracts now being offered to the city plant.

SEATTLE, WASH. — Plans have been completed by Architect Carl F. Siebrand, Northern Life building, for construction of the proposed wireless manufacturing plant of Kilbourne & Clark Manufacturing Company on the corner of East Marginal Way and Spokane street to cost about $80,000.

SEATTLE, WASH.—Authority to purchase proper site on Spokane avenue between Montana and Wyoming streets for construction of a substation has been requested by Superintendent of Lighting J. D. Ross of the city light department. It is proposed to remove transformers from the Yesler station as well as care for two new transformers already ordered.

SEATTLE, WASH.—Ordinance has been passed to the effect that approval be sought from the Capital Issues Committee for a bond issue of $1,200,000 for extending the municipal railway from the northern city limits via Tenth avenue, northeast to connect with elevated and Lake Burien lines.

SEATTLE, WASH.—City will ask the Capital Issues Committee for authority to issue $150,000 in bonds to extend the municipal railway on East Marginal Way from Spokane avenue to the city limits.

SEATTLE, WASH.—Permission has been obtained to cut Government timber for construction of the proposed municipal power plant on the Skagit river. Site has been selected for a power house, a sawmill and the sinking of a number of test shafts and pits to determine the general formation of the

ground. City Engineer Dimock recommends immediate construction of a road to the site of the proposed plant.

SEATTLE, WASH.—The city will ask the Capital Issues Commission for permission to issue $150,000 in bonds to extend the municipal railway on East Marginal Way from Spokane avenue to the city limits. An issue of $1,200,000 utility bonds to extend the municipal railway from northern city limits via Tenth avenue N. E. to connect with the elevated and the Lake Burien line is asked for in an ordinance.

SEATTLE, WASH.—Construction of the Skagit River power plant will begin at once. The Government has approved the proposed bond issue of $5,500,000 public utility bonds for the construction of the plant. Address City Engineer A. H. Dinock.

TACOMA, WASH.—Dean Landes of the University of Washington is making a survey of geological formation at Lake Cushman to locate difficulties in developing the power site which the city proposes buying from the Skokomish Power Company for $300,000

USK, WASH.—Mountain State Power Company will construct a power line, 20 miles in length, from Usk to Chewelah, Wash. The line is necessary to supply Chewelah with power, estimated to cost $90,000. Address G. N. Rooker, manager of the Mountain State Power Company.

ANGELS, CAL.—Angels Camp Deep Mining Company has recently completed the work of changing the motive power at its plant from steam to electric. J. C. Benson is president; M. Pugina is superintendent.

ARCADIA, CAL.—Extensive electrical work will be required in connection with the development of the new balloon school site by the United States Government, including the installation of new electric-lighting systems, etc.

FILLMORE, CAL.—In connection with extensive improvements and additions to the local plant of the Ventura Refining Company, estimated to cost in the neighborhood of $100,000, a large new electrically-operated pumping plant is planned.

FRENCH GULCH, CAL.—The power plant at the Crystal Creek mining properties of the Hazel Creek Gold Mining Company was destroyed by fire recently with estimated loss of about $30,000. The company is planning to rebuild the plant and in the meantime, it is understood, connection will be made with the transmission lines of the Northern California Power Company to furnish service.

FRESNO, CAL.—In connection with the construction of the local plant of the California Associated Raisin Company, a large new one-story reinforced-concrete power house will be erected for works operation. Plans for the structure are now being prepared. The entire work is estimated to cost about $150,000.

FRESNO, CAL.—The city has commenced the construction of a two-story reinforced concrete power plant, about 85x155 feet in size, at Sun Maid City, just south of Fresno.

FRESNO, CAL.—The city has taken bids for the installation of the proposed new electrolier system on South Van Ness avenue, the lowest being submitted calling for an expenditure of $11,514.

GAZELLE, CAL.—Edward C. Latchem is planning for water power development on Grouse Creek for the generation of electric power to the amount of about 400 theoretical horsepower for the operation of mining properties. Application has been made for permission to utilize 12 second feet of the stream.

INGOT, CAL.—Afterthought Copper Company is said to be considering plans for the construction of an electrolytic plant at its mining properties.

LA HABRA, CAL.—The city is planning for the immediate installation of an electric street lighting system.

LOS ANGELES, CAL.—The Southern California Edison Company has been granted a franchise by the County Board of Supervisors for the construction of a new transmission line on a portion of the county highways to connect with its present system. A similar franchise providing for the construction of a distributing system in connection with the new transmission line has also been approved.

LOS ANGELES, CAL.—Wilbur O. Lusk is considering plans for the construction of a large hydroelectric plant near Round Mountain for the development of about 7500 kilowatts. Application has been made to the Water Commission for 250 cubic feet per second of the Pit river, Montgomery creek, and Hatchet creek in Shasta county for this purpose.

LOS ANGELES, CAL.—Pacific Electric Railway Company will build a one-story brick substation, about 32x50 feet, at Slauson and Long Beach avenues. The company is also planning for extensions in its system to Yucaipa. Paul Shoup is president.

LOS ANGELES, CAL.—Southern California Edison Company has had plans prepared for the construction of a one-story brick station, about 60x100 feet, to be located at Myrtle and Walnut avenues, Monrovia. Joseph F. Rhodes, Central building, Los Angeles, is architect.

LOS ANGELES, CAL.—The Union Oil Company of California has awarded a contract for the construction of a one-story brick, steel and reinforced concrete boiler plant, about 60x70 feet in size, to be located at its plant at Wilmington. The Davidson Construction Company, Sixteenth and Tennessee streets, Los Angeles, is the contractor.

LOS ANGELES, CAL.—The city has completed plans for the construction of a new electric railway system between Redondo Beach and Torrance, about four miles in length, to provide adequate transportation facilities for workers employed in the various shipbuilding and war plants in the vicinity of San Pedro. It is said the work will cost approximately $100,000.

MANHATTAN BEACH, CAL.—The city trustees are considering plans for the immediate installation of new ornamental lighting standards and appliances on Neptune avenue and other streets.

OAKDALE, CAL.—The Waterford Irrigation District is considering a bond issue for $150,000 to provide for the installation of two large new pumping plants to be electrically-operated.

RICHMOND, CAL.—American Dredging Company, which has the contract for dredging Richmond's inner harbor, will start work immediately, using electric energy furnished by the Western States Gas & Electric Company.

SAN FERNANDO, CAL.—In connection with the construction of the proposed new plant of the San Fernando Canning Company, a large boiler works will be erected. Immediately upon completion of the structure, electric motors and boilers will be installed. The equipment for the plant is estimated to cost $45,000.

SAN FRANCISCO, CAL.—In connection with the new irrigation project of the Hastings Tract Company, it is proposed to construct an electric pumping plant on Lindsay river, a tributary of the Sacramento river in Solano county.

SAN FRANCISCO, CAL.—Contract has recently been awarded to the General Electric Company by the Board of Public Works, for new electric storage locomotives for use at the hydroelectric system at Hetch Hetchy, at $39,-162.

SAN FRANCISCO, CAL.—G. H. Canoles, Delavan, is considering plans for the construction of an electrically-operated pumping plant in connection with the irrigation of a large tract of property.

SAN JOSE, CAL.—The city has granted approval to the application of Giles Bradley and associates for permission to construct and operate a telephone system connecting Morgan Hill and Uvas.

SAN FRANCISCO, CAL.—Weidenthal Gosliner Electric Works are building a new addition to their plant, to provide for increased capacity. The company has also leased additional space at Mission and New Montgomery streets, to be used for extensions.

SAN FRANCISCO, CAL. — Great Western Power Company is said to be negotiating with the United States Government for the construction of a large hydroelectric plant near Oroville. It is understood that the plant will cost in excess of $3,000,000, and will be financed by the Government.

SAN FRANCISCO, CAL.—Southern Sierra Power Company and the Holton Power Company, an affiliated organization, have made application to the State Railroad Commission for permission to increase their rates for service. The increases are asked to provide for the installation of new hydroelectric facilities to meet increased operating expenses, etc.

SANTA BARBARA, CAL.—The City Council is planning for the immediate installation of new reinforced concrete ornamental lighting standards on Chapala street, from Ocean boulevard to Guterrez street.

STOCKTON, CAL.—Western States Gas & Electric Company is constructing a dam at Twin Lakes to impound 1000-acre feet of water. The company's output of electrical energy for the Stockton division during the week ended June 28 was 28.3 per cent greater than for the corresponding week last year, and there was an increase of 59 per cent in gas output for the same period.

Trade Activities

Many Companies Issue New Literature on their Activities —Farm-Lighting Equipment in Big Demand—Other News

T. C. White Electrical Supply Company, St. Louis, is supplying armature wedges, made of hard maple, to any specifications. Among the users of this product are some of the largest manufacturers in the country.

Great Western Electric Company, Ltd., of Regina, Sask., Can., has changed its name to the Midland Electric Company, Ltd. This change was made owing to the name of the Great Western Electric Company conflicting with other companies with similar names.

Advance Electric Company, St. Louis, Mo., is distributing a leaflet describing its type WS single-phase constant-speed motors of small size. The important feature of this type motor is the automatic device that changes the motor from a repulsion to a straight induction machine. Sizes of from one quarter to two horsepower are listed. The motor is made for standard voltages.

Allis-Chalmers Manufacturing Company, Milwaukee, Wis., illustrates and describes its type "N" potential starters in bulletin 1102 just issued. This starter is of the transformer type, consisting of a pair of auto-transformers for reducing the voltage applied to the motor during starting and an oil-immersed drum-type switch for making the necessary changes in connections. It is designed for squirrel-cage induction motors for 25 and 60 cycle operation.

Beardslee Chandler Manufacturing Company, Chicago, Ill., is offering a number of bargains in novelty electric candles, designated as "service sticks." Five varieties are illustrated and described in a circular just issued. Each candle is decorated with a service star of blue with two red stripes. The candles are designed for use in windows, on mantles, dressing tables, etc., and are furnished with or without shades.

Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has just issued a four-page envelope folder entitled "War-Time Control of Light" (Publication 271). The folder points out that current, copper and coal may be saved by the judicious use of pull switches properly placed, thus permitting lights not needed to be promptly cut out of circuit. C-H pull switches have the high capacity rating of 6 amperes at 125 volts, which makes them of particular value for controlling large groups of lamps, as for instance, in indirect lighting units where a switch of only 3 amperes rating would be of insufficient capacity. These pull switches are made with various sizes and styles of caps. One number has a large porcelain base to fit a standard 3¼-inch outlet box.

Burton-Poore Electric Company, Inc., has incorporated at Norfolk, Va., to conduct a general electric supply business. The maximum capital is placed at $5000 and the minimum at $500. J. M. Burton is president of the company and E. S. Poore, secretary- treasurer.

The Industrial Electric Furnace Company, Chicago, maker of the Snyder electric furnace, is installing a 5-ton furnace in the plant of the Zimmerman Steel Company, Bettendorf, Iowa. It is a three-phase furnace, designed for acid operation, and will be used for general work. C. H. Atherton, manager of the Zimmerman Steel Company, ordered the installation to replace the converter which that company had previously been using.

The Ideal Commutator Dresser Company, of Chicago, Ill., has developed a new commutator resurfacer, which is now being placed on the market. It is designed for use when the commutator to be resurfaced is running under regular load. This resurfacer is an abrasive material in block form, conveniently mounted on a handle. It is non-metallic, non-copper collecting, and therefore will not cause short-circuiting or wear smooth. When held against the revolving commutator, it cuts down high mica bars and high spots, and leaves the commutator in perfect condition, according to the claims of the manufacturer.

Cutler-Hammer Manufacturing Company, Milwaukee, Wis., manufacturers of electric controlling devices and allied apparatus, announces the opening, on September 3, of a branch office in the Union Trust Building, 15th and H streets, N. W., Washington, D. C. H. W. Knowles and C. W. Yerger, engineers, who are entirely familiar with the company's products, will be located at this new office. It will be operated entirely for the purpose of giving service to the Government and others having occasion to require information regarding the company's products, orders, contracts, etc.

Western Electric Company, New York City, is mailing a folder entitled "New Business." A variety of electrical products manufactured by the company, including electrically operated drills, grinders and hammers; soldering irons and glue pots; hoist equipments and ventilating outfits, sewing machine motors, industrial type heaters, vacuum cleaner, floodlighting units, "Square D" safety inclosed switches, are pictured. A number of views of the Western Electric alternating and direct current motors are shown. This company's utility motor is featured as being adaptable and portable, and suitable for odd jobs everywhere. With each folder is enclosed a post card, the mailing of which to the Western Electric Company is the step in a campaign for new business.

"Jack-up," the new-business curve on your sales sheet for 1918 is the slogan accompanying a picture showing the way in which new business can be increased by appliance sales to industries. Line up with Western Electric service—it pays, is the theme throughout this circular that has gone out to every electrical appliance dealer in the country.

The advertisement of this company entitled "Electrically Equipped"—an essential war economy, featuring Habirshaw insulated wire which appeared during July and August in the Saturday Evening Post, Literary Digest and Manufacturers Record, and will appear in Factory next month, has been reproduced and mailed to all electrical dealers in the country by the Western Electric Company.

Main Electric Manufacturing Company, manufacturer of electric lighting and power plants, Pittsburgh, Pa., is experiencing great activity in supplying Main plants to farms. The intensive effort on the farm, the shortage of labor and the present prosperity have combined to show the farmer the need for electric light and power. If the present demand for these farm lighting outfits may be taken as a barometer for the early fall and winter, more outfits will be sold this year than during any other season in the past by several times over. A large 40-page catalog profusely illustrated, describes the Main plant from the ten-light size selling at little over $100 to the 600-light size.

The Main Electric Manufacturing Company reports that Main lighting outfits are being readily taken up in foreign lands. In Australia a contract has been signed for 597 of these plants, fifty of which are to be given immediate delivery. It was necessary for the distributing agent in Australia to travel 12,000 miles, requiring over five weeks of travel, in order to complete arrangements for this agency. The policy of the Main Electric Company has recognized the legitimate established dealer and electrical jobber as the outlet for its product, and when the matter is up of a new dealer or a new distributor this policy is always adhered to and the jobber and dealer are given the preference. The Wesco Supply Company of St. Louis has recently been added to the list of distributors and as a result a considerable amount of business throughout the Mississippi Valley is expected. A vigorous campaign will be conducted.

Recent Patents

Selected and Summarized by Albert Scheible, Patent Attorney, 79 West Monroe Street, Chicago, Illinois

A series of brief comments on some of the recently issued electrical patents which appear to be of particular interest to our readers, the number after each heading being that of the United States patent to which the summary relates. Any correspondence regarding such patent matters should be sent direct to Mr. Scheible at the above address.

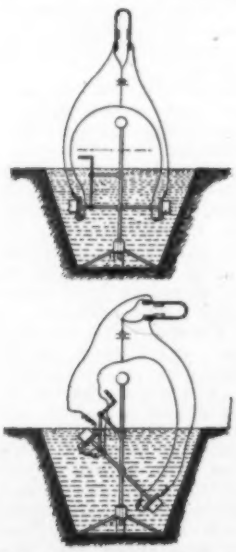
Inclosed Safety Fuse (1,270,391).—A simple method of aligning the parts in their proper positions is disclosed in this patent on a ferrule-type cartridge fuse, assigned by Alfred L. Eustice (of Chicago) to the Economy Fuse & Mfg. Co.

Welding Dissimilar Metals (1,270,860).—For electrically welding two pieces of metal having different melting points, Harold A. Newcomb (of Wilkinsburg, Pa.) heats these simultaneously, but substantially in proportion to their melting points, until surface diffusion is effected.

Combined Telegraph and Telephone Instrument (1,270,861).—A receiving instrument, designed by Herman G. Pape (of New York City) to be held to the ear for the private delivery of telegraphic ticks. A simple adjustment converts the same instrument into a telephonic sounder or articulate speech reproducer.

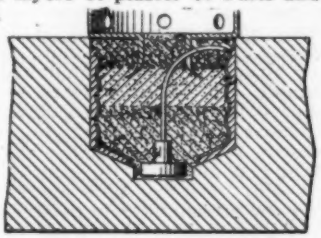
Inclosed Fuse (1,270,867).—Charles S. Price (of Rutherford, N. J.) provides means for causing the fuse to be ruptured at a point near the non-vented end of the inclosing sheath. (Patent assigned to the Western Electric Co.)

Transmitting and Locating Sound Waves (1,270,398).—To avoid losses from the irregular travel of sound waves through the ground, Reginald A. Fessenden (of Brookline, Mass.) immerses the sound receiving instruments in a tank of water. By connecting two such microphones to a differentially wound telephone and mounting the instruments on a bar pivoted to a post, he can swing this bar until the sound waves are equalized, thus determining the direction from which the sound came. Likewise, by using two such devices at some distance from each other, the intersection of the sound-wave lines will locate the source of the sound.



No. 1,270,398.—Sound Wave Transmitter and Locater.

Electric Fuse Plug (1,270,048).—In the fuse plug devised by Thomas E. Murray (of New York Ctiy) the fuse passes through three layers, namely two layers of plaster of Paris and an intermediate layer of a finely divided refractory material, such as dry plaster. The fuse is reduced in section at a point disposed in this intermediate layer, so that the blowing will occur there.



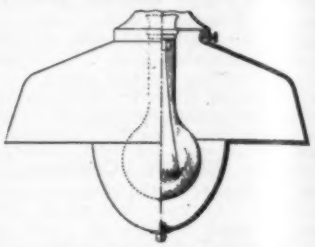
No. 1,270,048.—Electric Fuse Plug.

Combined Engine and Dynamo Frame (1,272,949).—Where an electric generator and an electric starting motor are both to be used in connection with the engine of a vehicle, William J. Hart (of Mount Vernon, N. Y.) casts the field frames and pole pieces of both the motor and the generator, both an integralp art of the engine.

Combination Flash-Light and Camera (1,272,635).—A pistol shaped appliance patented by Charles De Marco (of Rochester, N. Y.) has a camera in the cylinder of the revolver, an illuminating light forward of the lens of the camera, and a battery in the handle.

Shielding System for Vapor Converters (1,272,621).—Electrostatic action is employed by Lewis W. Chubb according to this patent (assigned to the Westinghouse Electric & Mfg. Co.) for restricting the arc between two electrodes in a vapor converter to a portion only of one of the electrodes.

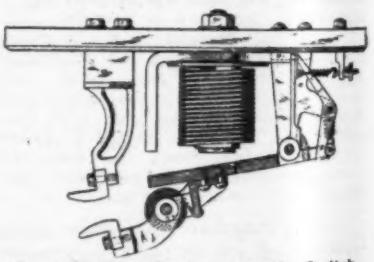
Lighting Fixture (1,270,932).—To make a dust-proof semi-direct lighting unit, Florenz M. Egan (of Mount Vernon, N. Y.) connects the bowl with the hood by a horizontal glass ring, thus making a single-piece lighting unit.



No. 1,270,932.—Lighting Fixture.

Arc Lamp Electrode (1,272,401).—For this purpose Henry R. Edgecomb (of St. Marys, Pa.) uses an inner core and an outer shell designed to burn at approximately the same rate as the inner core. The shell is coated with a material of high electrical conductivity and is spaced from the core by a film of electrically conducting but heat-insulating material. Carbon is mentioned as an ingredient for such a film.

Electromagnetic Switch (1,271,001).—Two magnetic circuits of differing reluctance are employed by Paul H. Timmer of Milwaukee for positively locking an electromagnetic switch in its open position when the current through its operating winding is above a critical value. (Patent assigned to the Cutler-Hammer Mfg. Co.)



No. 1,271,001.—Electromagnetic Switch.

Battery Depolarizers.—Among the recent patents on depolarizers assigned by various inventors to the National Carbon Co. are finely divided psilomelane (Carleton Ellis, No. 1,272,406), and graphite compressed with artificial and substantially non-conducting manganese dioxide. (Carleton Ellis, No. 1,272,407); also molybdenum trioxid (Major E. Holmes, No. 1,272,952).

Men in Service

Electrical Men Continue to Respond Loyally to Call of Government—Thomas Edison Takes His First Vacation

A. C. EDDY, engineer of maintenance of way of the British Columbia Electric Railway, Vancouver, B. C., has been appointed a captain with the 55th U. S. Engineers.

RALPH O. WALTHAM, formerly of the electric distribution department of the Pacific Gas & Electric Company at Oakland, Cal., was recently commissioned second lieutenant in the Aviation Section, and is at present taking a course in aerial gunnery.

CLAIRE H. LAW, district manager of the Interstate Independent Telephone & Telegraph Company, with headquarters at Sterling, Ill., has resigned his position to take up Y. M. C. A. work in France.

W. K. MCQUOWN, of Sherman, Texas, general superintendent of the Associated Telephone Companies of North Texas, is now in the engineering department of the Signal Corps and is located at Washington, D. C.

R. H. MCKIBBEN, who for the past year has been engaged on hydroelectric construction work with the Cerro de Pasco Mining Company at Pachachaca, Peru, is now connected with the Southwest Cotton Company, Phoenix, Ariz., in the capacity of electrical engineer.

THOMAS A. EDISON, West Orange, N. J., has left for a two-weeks' vacation in the south. In company with Henry Ford, John Burroughs, and others, Mr. Edison will spend the time in camping in the southern woods. This is the first vacation he has taken since the country entered the war.

CHARLES E. HESTON, who last summer was awarded a commission as captain in the United States Signal Corps, has been promoted to the rank of major. Major Heston has had a wide and varied experience in the manufacturing and operating ends of the telephone business and is well know to Independent telephone men.

T. D. RAUCH, salesman in the Electric shop of the Little Rock Railway & Electric Company, has left the company for war service, having entered a radio school at the University of Arkansas.

GLENN C. KILEY, of the rate department of H. M. Byllesby & Company, Chicago, has joined the National Army and will for the present be located at Camp Grant.

SOCIETY OF AUTOMOTIVE ENGINEERS in the August number of its journal records the following names of members who have entered Government service in civilian or military capacities: Military, C. .M Billings, A. Gray Churchward, Simon R. Dee, Allen A. Gould, Richard Kent, Victor W. Page, Dent Barrett, S. Ward Seeley, and T. W. Sheahan; civilian, William G. Brown, Charles W. Claaseen, F. Leroy Hill, Jr., Charles B. King, C. W. Lincoln, Arthur S. Mann, Charles C. Munson, A. W. Russell, Joseph E. Smith, Leslie V. Spencer.

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for Men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service-aside from those who have voluntarily entered or been called for service.

THE ELECTRICAL REVIEW *will welcome news concerning men who have entered the service or who are engaged in any patriotic duties.*

HARRY ROTHSTEIN, purchasing agent and general manager of the electrical supply department of the Eclipse Light Company, New York City, has left for Paris Island, S. C., where he becomes a member of the Marine Corps.

C. H. O'REILLY, formerly of the accounting department of H. M. Byllesby & Company, Chicago office, stationed at Fort Sill, Okla., has been commissioned a lieutenant in the Quartermaster's Corps as a result of his work at the Quartermaster's School at Jacksonville, Fla.

EDWIN H. ROBNETT, formerly connected with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is now a first lieutenant in the Engineers Officers' Reserve Corps, commander headquarters company, 109th Regiment, located at Camp Cody, Deming, N. M.

DR. J. E. COSGROVE, identified with the telegraph service in New York and vicinity, and who has practiced medicine for many years in New York, has been commissioned captain in the Medical Section of the Army. He has been assigned to duty at Camp Greenleaf, Georgia.

MAJOR J. O. MAUBORGNE, who has been in charge of the electrical engineering section of the Signal Corps in the War Department, Washington, since March, 1918, was born in New York City in 1881. He was graduated in 1901 from the College of St. Francis Xavier. Major Mauborgne has during the past ten years specialized in radio work, and during 1914 and 1915 was in charge of army radio construction work in the Philippine Islands. During 1916 and 1917 he was on duty at the Fort Leavenworth Army Signal School, acting as director. He is the author of the well known radio work, "Practical Uses of the Wave Meter in Wireless Telegraphy," published in 1914.

MAJOR E. B. CRAFT, recently appointed assistant chief engineer of the Western Electric Company, New York, began work with the company as factory engineer in the year 1900. From 1913 until 1916 he was connected with the Hawthorne plant of the company as superintendent of the technical branch. Returning to New York in November, 1916, he served as head of the inspection branch of the engineering department, in which position he remained until his recent promotion. Major Craft is a native of Ohio and a graduate of Cornell University.

TELEPHONE MEN IN GOVERNMENT SERVICE.—Theodore N. Vail, president of the American Telephone & Telegraph Company, issued on July 31 the following circular to the employes of the Bell Telephone Companies:

Under the authority of the law and by the proclamation of the President, possession and control of the wire systems pass to the Postmaster General as of August 1. In a conference held in Washington at which were present the Postmaster General, the government operating committee and representatives of the Bell Companies, the Postmaster General expressed most emphatically his appreciation of the service which the Bell companies were rendering, and that such improvement possible to be made would be because of the additional power derived from the government. He asked for the co-operation and assistance of those who had heretofore been responsible for the service. The Postmaster General was equally emphatic in the statement of his desire to conserve the service and properties of the companies with a view of returning them when called upon so to do to the owners in as good condition as received. That it was his earnest desire that the owners should receive just compensation in the full sense for their use. The Postmaster General, until other instructions are issued, desires that the conduct of operations shall continue as heretofore and also states that no changes will be made until after consultation and full and careful consideration. To all who are identified with the Bell companies—who have shown your fine sense of obligation and your loyalty and fidelity to the country, to the public service and to the property in the past and to whom the credit is due for the prestige and position of the companies in the public eye—it is asked, and it is not too much to ask of you, that same loyalty, fidelity and devotion to the service under the new order of things. On your behalf such loyalty, fidelity and devotion to service have been promised, knowing full well the spirit in which you would meet and respond to the request. To do one's full duty in each position is the greatest obligation resting upon every person and is also the greatest opening to future preferment.

Personal

C. E. Drayer, Appointed Secretary American Association of Engineers—John B. Peck Succumbs—Other Changes

V. L. BLANCHARD, special representative of the new-business department of the Toledo Railways & Light Company, Toledo, Ohio, has joined the Brush Electric Company at Galveston, Tex., whom he will serve as new business manager.

IRA W. FISKE, who has been a member of the electrical engineering faculty of the University of Illinois for several years, has resigned that position to become head of the electrical engineering department in Drexel Institute of Technology, Philadelphia, Pa.

J. KAPPEYNE, formerly chief engineer of the Public Utilities Commission of the District of Columbia, has recently been appointed transportation engineer to the United States Fuel Administration for the State of Illinois, with headquarters in Chicago.

O. F. BROCK has been appointed purchasing agent of the Birmingham Railway, Light & ower Company, Birmingham, Ala., succeeding Charles C. Doerr, who resigned to become local purchasing agent for the Air Nitrates Corporation at Birmingham.

DAVID F. ATKINS has resigned as chief engineer of light and power of New York City to join the forces of the Lord Electric Company, New York City. Mr. Atkins will act in the capacity of mechanical equipment engineer for the Lord Company.

JOHN W. BROOKS, general manager for Pass & Seymour, Solvay, N. Y., manufacturer of electrical specialties, has been appointed a member of the new Community Labor Board for the Tenth District, now being formed for the purpose of conferring on labor.

BRICE H. REID has severed his connection with the Brice H. Reid Company, Elkhart, Ind., as president and its chief owner, and has formed the Reid Electric & Supply Company, wholesale jobbers. The Brice H. Reid Company will continue in business with Gene E. Ohmer, manager, and E. G. Dean, chief salesman.

CHARLES A. STANLEY, who has for some time past been connected with the Kansas Gas & Electric Company, Wichita, Kans., as commercial engineer, was recently appointed new general superintendent of the company. George Theis, president of the company, has relinquished the detail work of operating the road and it will in the future be directed by Mr. Stanley.

R. U. STEELQUIST, formerly manager of the Oregon Powei Company at Dallas, Ore., has been promoted to Manager of the Albany (Oregon) Division of the Company, succeeding J. L. White, resigned. H. A. Joslin, formerly local manager of the company at Eugene, has been appointed to succeed Mr. Steelquist at Dallas. Fred Brown, of the Tacoma Gas Company, has been appointed local manager at Eugene.

A. O. NIEL, of Jackson, Miss., has been made local manager of the Arkansas Light & Power Company at El Dorado, Ark. Mr. Niel succeeds B. O. McKinnon who has been transferred to Pine Bluff.

E. G. HOWARD, who has for many years been intimately connected with the electrical industry in the Northwest, was recently appointed district manager of the Minneapolis office of the Moloney Electric Company, manufacturer of transformers, St. Louis, Mo.

ARTHUR H. YOUNG, director of the American Museum of Safety since January 1, 1917, has resigned to take charge of the employ relations department of the International Harvester Company. Although Mr. Young has given up the actual direction of the museum's work, he will continue to be closely connected with its affairs, having been elected to the vice-presidency to succeed the late Dr. Frederic R. Hutton.

WALTER J. HODGKINS, former manager of the construction department for the Ashland Light, Power & Street Railway Company, Ashland, Wis., has been made manager for the entire works following the resignation of F. R. Winders. Mr. Hodgkins will have charge of all of the work of the company, which includes interests in Ironwood, Bessemer, Wakefield, Hurley and Washburn. The company also furnishes power for lights at the Barksdale plant.

FRANK L. WURL, who has been intimately connected with many new developments in automotive ignition, starting and lighting, has been appointed sales engineer of the Remy Electric Company, Detroit, Mich. Mr. Wurl joined the Remy Company a few years ago as electrical engineer, but his marked ability soon placed him at the head of the research laboratories, where he has directed many moves in the constant improvement of Remy equipment.

Obituary.

WILLIAM CABBLE PROVOST, treasurer of the William Cabble Excelsior Wire Works Manufacturing Company, Brooklyn, N. Y., manufacturer of electrical wires, etc., died recently at his apartment in the Hotel Chatelaine, Brooklyn, of heart failure. Mr. Provost was 51 years of age.

GEORGE C. MAYNARD, curator division of mechanical technology, United States National Museum, and an old time and military telegrapher, passed away at Washington, D. C., on July 28, at the age of 78 years. Mr. Maynard was closely associated with the early development of the telephone, having entered service in Washington in 1877 where he constructed and leased wires for private telephone lines. He organized the first exchange in Washington and held the active management until March, 1881. He was a frequent contributor to the technical press and was the Washington correspondent of the ELECTRICAL REVIEW for many years. Mr. Maynard was prominently identified with the Old Time Telegraphers and Historical Association as well as with many other historical and fraternal societies.

JOHN B. PECK, president of W. R. Ostrander & Company, died at his home, Hotel Chatelaine, Brooklyn, New York, on August 9. In the death of Mr. Peck the electrical industry has sustained a distinct loss in the passing of another pioneer. Mr. Peck, who died very suddenly of apoplexy, was a man who studiously avoided publicity and found his greatest pleasure in the quiet development of the affairs of his company, which from a small beginning he successfully guided to a commanding position in the electrical trade, as manufacturers and wholesalers. Mr. Peck was born in New England in 1851, and entered the firm of W. R. Ostrander & Company in 1882, which business had been established in 1853 and was at that time identified in hardware and building supply lines. Having at an early date obtained an interest in the company and aware of the possibilities of electrical development, Mr. Peck entered this field, thus becoming one of the first electrical supply dealers in New York City. Under his able guidance the business soon expanded, until the need of a factory was apparent and the first of a series of manufacturing plants, owned or operated by this company was then established in Brooklyn, New York, for the production of bells, push buttons, annunciators, letter boxes and other electrical house goods, as well as speaking tubes, with all of which this house has been identified for many years. Mr. Peck was unmarried, a man of unusually sunny temperament and an employer who treated his help as a large family, many of them having been in his employ for twenty and thirty years, and during that time having been assisted by him in the purchase of company stock. Those who were fortunate to possess his acquaintance have lost a valued and helpful friend, and the electrical trade an upright and progressive leader. It is understood that Mr. Peck has left provision for the continuance of this old established electrical house without interruption. The business will continue by the same management. C. P. La Shelle, who has for a number of years been vice-president and general manager, has been elected president of the concern in place of the late John B. Peck. W. H. Vogel, who has been connected with the concern for the past twenty years has been elected to succeed Mr. La Shelle as vice-president. W. H. Roberts, who has been secretary and treasurer, and looking after the finances of the business will continue in the same capacity.

Financial News

Westinghouse Earns at $12.32 Rate.

Westinghouse Electric & Manufacturing Company, in the three months to June 30, the initial quarter of its fiscal year, earned net income of $5,200,000 after all charges except taxes. This was an increase of $1,600,000 over the showing in the corresponding quarter of the preceding year. After allowance of full dividends on the preferred and common stocks, which share alike, and a 100 per cent greater set-up for taxes than in June quarter of 1917, a balance of $1,000,000 was carried to surplus.

Quarterly dividend requirements on the $74,812,650 capital stock amounted to $1,309,220. Adding this sum to the balance carried to surplus and deducting the total from net income before taxes, the reservation for taxes is shown to have been $2,890,780 and the balance available for dividends after taxes to have been equal to $3.08 per share or at the annual rate of $12.32 per share, compared with $10.29 per share earned in the fiscal year ended March 31, 1918.

This high rate of earnings despite the burden of war taxation is a reflection of the heavy business which is absorbing the full capacity of the company's plants. As of March 31, 1918, unfilled orders aggregated $147,857,580, inclusive of war contracts. Of this total, $110,185,087 comprised orders for the corporation's regular products, but the proportion of plant capacity at present being devoted to government work is understood to be above 60 per cent.

Company officials are withholding production figures of the plants of the New England Westinghouse Company, which are at work on Browning machine guns of the heavy type, until the government itself gives out the information. However, it can be stated that every promise is being fulfilled. Deliveries began last April.

Figures authorized by War Department show that New England Westinghouse Company turned out in June 2,129 heavy Browning machine guns against schedule of 200 and over 3,000 in July against 400 schedule. Contract calls for completion by December, but company is two months ahead of schedule. Present output is close to 200 heavy Brownings a day, which is not 50 per cent maximum capacity.

Westinghouse Electric is turning out steam turbine engines for ship propulsion machinery at an extraordinary rate. The new Essington plant at tidewater on the Delaware River near Philadelphia is entirely devoted to this work. The plant has a total floor space of 600,000 feet and Charles M. Schwab, Director-General of Emergency Fleet Corporation, has announced plans providing for a 40 per cent expansion of its capacity.

Northwestern Electric to Issue Stock.

Approval of the War Finance Corporation for the issuance of a fund of $1,000,000 has been granted the Northwestern Electric Corporation, the proceeds of which are to be used for extensions, improvements, etc., to increase the present capacity of its plant. It is understood that the loan will be financed by the Government.

New Issue for Northern States.

The Guaranty Trust Company, New York; Illinois Trust & Savings Bank, Chicago; H. M. Byllesby & Company, Bonbright & Company and Spencer Trask & Company compose a syndicate offering an issue of $2,000,000 five-year sinking fund convertible 7 per cent notes of the Northern States Power Company (Minnesota). The offering price will be 96 and interest, yielding about 8 per cent on the investment. The notes are to be dated August 15, 1918, and will fall due August 15, 1923, and are convertible at any time after January 1, 1919, into 7 per cent cumulative preferred stock or common stock of the Northern States Power Company (Delaware) at a price of par for the notes, 95 for the preferred stock and 100 for the common stock with adjustment for accrued interest and cash dividends. Strong sinking fund provisions will retire 45 per cent of the notes before maturity. It is expected that public offering will be made during the next week.

San Diego Company Sells $150,000 Notes.

The San Diego Consolidated Gas & Electric Company, San Diego, Calif. (a Standard Gas & Electric Company subsidiary), has sold an issue of $150,000 five-year 6 per cent collateral trust gold notes under authorization of the Railroad Commission of California and approval by the Capital Issues Committee.

Federal Aid Given Union Gas & Electric.

The Government will loan to the Union Gas & Electric, a subsidiary of Columbia Gas & Electric, approximately $2,000,000 for the erection of a third unit of the Union company's new generating plant in Cincinnati. The company acting as agent for the Government, will build a $1,000,000 transmission line from its plant to the Government's new nitrate plant.

U. S. Copper Exports.

	Pounds. 1916.	Pounds. 1917.
Ore (copper content)	4,818,828	4,969,033
Concentrates (copper content)	965,940	821,477
Unrefined black blister and converted copper (bars, pigs and other forms).	18,263,118	17,215,445
Refined in ingots, bars, rods or other forms	716,616,763	1,029,633,943
Composition metal, copper chief value		*1,230,910
Old and scrap	815,825	1,183,109
Pipes and tubes		*7,273,480
Plates and sheets..	24,843,435	42,664,943
Wire	23,467,345	26,880,587
	789,791,254	1,131,872,927

*Figures covering period beginning July 1.

Milwaukee Electric Railway & Light To Issue Bonds.

The Milwaukee Electric Railway & Light Company has been authorized to issue $3,000,000 in bonds and $2,000,000 in notes. The bonds are to be sold to the Wisconsin Edison Company in discharge of indebtedness of the Milwaukee Electric Railway & Light Company at not less than 75. The proceeds of the sale of the notes, at not less than 75, are to be used in paying off the floating indebtedness of the company.

Ratify Telephone Bond Plan.

The stockholders of the American Telephone & Telegraph Company have voted to authorize the issue of $50,000,000 6 per cent seven-year convertible bonds at 94. These bonds are convertible into common stock after August 1, 1920, at 106. Stockholders are given the right to subscribe to the bonds up to 10 per cent of their holdings.

Montana Power Stock Offered.

Lee, Higginson & Company are offering $1,500,000 Montana Power Company first and refunding mortgage 5 per cent sinking fund gold bonds at 89 and accrued interest, yielding over 5.80 per cent. The bonds are part of an original issue of $4,000,000.

The Pacific Gas & Electric Company reports for June gross earnings $1,860,815, compared with $1,663,832 for June, 1917; net after taxes, including miscellaneous income, $783,781, compared with $747,083; surplus after charges and preferred dividends, $300,548, compared with $257,849.

Dividends.

Federal Utilities Company, Inc., has declared a quarterly dividend of 1½ per cent on preferred stock, payable September 3 to stock of record August 15.

Connecticut Power Company has declared a quarterly dividend of $1.50 on preferred stock, payable September 3 to stock of record August 22.

The directors of Cities Service Company have declared the regular monthly cash dividend on the preferred stock of one-half of 1 per cent, or at the rate of 6 per cent per annum, and the regular monthly cash dividend of one-half of 1 per cent, or 6 per cent per annum, and three-quarters of 1 per cent, or 9 per cent per annum in stock, on the common stock.

American Telephone & Telegraph Company has declared a quarterly dividend of $2 per share, payable October 15 to stock of record September 20.

Northern Texas Electric Company has declared a dividend of $2 per share; also a semi-annual dividend of $3 on preferred stock, payable September 3 to stock of record August 19.

West Penn Traction & Water Power Company has declared a quarterly dividend of 1½ per cent on preferred stock, payable September 15 to stock of record September 1.

American Power & Light Company has declared a quarterly dividend of 1 per cent, payable September 1 to stock of record August 23.

Montana Power Company has declared quarterly dividend of 1¼ per cent, also a quarterly dividend of 1¾ per cent on preferred stock, both payable October 1 to stock of record September 14.

Rochester Railway & Light Company has declared a quarterly dividend of 2½ per cent on preferred stock, payable September 3 to stock of record August 26.

The Northern Texas Electric Company has declared a semi-annual dividend of $3 a share on the preferred stock and a dividend of $2 a share on the common stock, both payable September 3 to stockholders of record at the close of business Aug. 19.

The Pacific Gas & Electric Company has filed an application with the California Railroad Commission for authority to issue and sell before the end of 1918 $5,000,000 of its general and refunding mortgage bonds at not less than 85, or $5,000,000 of its first preferred stock at not less than 82½.

Federal Utilities Company, Inc., has declared a quarterly dividend of 1½ per cent on preferred stock, payable September 3 to stockholders of record August 15.

Philadelphia Electric Company has declared a quarterly dividend of 1¾ per cent, payable September 14 to stock of record August 20.

Henry L. Doherty & Company and Montgomery & Company have formed a syndicate to underwrite $6,000,000 convertible 7 per cent gold debenture bonds of company named in title. The bonds are to be offered to stockholders for subscription at 102½. The bonds are part of an authorized issue of $30,000,000, of which $3,000,000 was disposed of last March. The proceeds of the new offering are to be used in developing the company's oil land holdings in Kansas and Oklahoma. After January 1, 1920, the bonds will be convertible into Cities Service stock in proportion of 80 per cent of preferred and 20 per cent of common for each $100 par value of bonds.

Earnings.

AMERICAN TELEPHONE & TELEGRAPH.

For June—		Increase.
Operating revenue	$ 2,927,738	$ 286,355
Operating income	1,345,122	160,926
From Jan. 1—		
Operating revenue	17,384,545	1,360,512
Operating income	8,188,481	694,481

POSTAL TELEGRAPH & CABLE COMPANY OF NEW YORK.

For the five months to May 31—Gross, $920,503; increase, $50,942; operating deficit, $24,327; increase, $8,875. May gross, $186,930; increase, $4,811; operating deficit, $13,324; decrease, $6,358.

LAKE SHORE ELECTRIC.

For June—	1918.	Increase.
Gross earnings	$186,672	$ 32,676
Operating and taxes	126,267	26,256
Net	60,405	6,419
Jan. 1 to June 30—		
Gross earnings	958,841	144,919
Operating and taxes	711,564	146,500
Net	247,276	1,581

PENNSYLVANIA UTILITIES SYSTEM.

Comparative statement of operating income:

	July— 1918.	1917.
Total operating revenues	$128,190	$ 88,238
Operating expenses and taxes	93,557	81,171
Operating income	$ 34,633	$ 7,067
Seven months ended July 31:	1918.	1917.
Total operating revenues	$884,719	$647,509
Operating expenses and taxes	660,617	524,682
Operating income	$224,102	$122,827

AMERICAN LIGHT & TRACTION.

American Light & Traction Company, for the 12 months ended June 30, 1918, reports earnings as follows:

	1918.	1917.
Gross earnings	$5,226,705	$5,503,731
Net earnings	4,911,022	5,171,520

Officials of the company point out the same rate increases have recently been granted to the company, and others are now under consideration. Gas sales of subsidiary companies increased $692,750, or 10.37 per cent; electric sales $135.761, or 10.65 per cent; and traction receipts $338,411, or 57.07 per cent.

KAMINISTIQUIA POWER COMPANY.

Gross earnings of Kaministiquia Power Company, Limited, for the month of June amounted to $34,778, an increase of $1,763. After providing for operating expenses, maintenance and fixed charges the surplus was $20.393, against $19.708 for June, 1917. Gross for eight months was $227,644, an increase of $25.653. After operating, maintenance and fixed charges the surplus for eight months was $165,351, an increase of $13,726. The balance sheet now shows total assets of $4,990,440.

MANHATTAN ELECTRICAL SUPPLY COMPANY.

Manhattan Electrical Supply Company, Incorporated, reports sales of $2.637.662 for the first six months of the present year, as compared with $2.487,087 for the corresponding period of 1917.

UTAH POWER & LIGHT.

The Utah Power & Light Company, including the Western Colorado Power Company, reports for June:

Gross earnings, from operating	$ 439,491
Operating expenses, including taxes	209,318
Net earnings from operating	221,173
Balance	90,000
12 months—	
Gross earnings from operating	5,438,003
Operating expenses, including taxes	2,624,000
Net earnings from operating	2,813,913
Balance	1,260,992

NORTHERN TEXAS ELECTRIC COMPANY.

For June—	1918.
Gross earnings	$ 259,163
Net earnings	103,410
Surplus after charges	75,238
For the 12 months ended June 30—	
Gross earnings	3,078,818
Net earnings	1,417,803
Surplus after charges	1,074,172

National Conduit & Cable Makes Report.

The National Conduit & Cable Company has issued the following estimated income account covering operations for the three months ended June 30, 1918, which shows a loss of $102,055 for the quarter, compared with a loss of $292,413 for the first quarter. A comparison of the second and first quarters follows:

	Quarter ended June 30, 1918.	Quarter ended March 31, 1918.
Net sales	*$4,142,528	$3,455,846
Manufacturing costs and expenses	4,091,105	2,612,685
Net operating profit	51,733	126,839
Other income	33,484	13,580
Total income	85,216	113,259
Taxes	35,294	30,642
Organization expenses	6,000	6,000
Interest charges	76,048	72,214
Depreciation reserve	68,929	70,297
Deficit for period	102,055	292,413

*Owing to the high percentage of "toll" business, where the customer furnishes the metal and consequently is not billed therefor this figure appears relatively low.

EARNINGS WESTERN STATES GAS & ELECTRIC CO.

Gross and net earnings of the Western States Gas & Electric Company for the month of July, 1918, and for the year ended July 31, 1918, compared with the corresponding previous periods are as follows:

Month of July.	1918.	191
Gross earnings	$ 139,179	$ 160,3
Net earnings	53,859	52,73
Year ended July 31.		
Gross earnings	1,541,629	1,320,39
Net earnings	664,526	628,43

COLORADO POWER COMPANY.

For June—	1918.	1917.
Gross earnings	$103,451	$93,31
Net earnings	54,281	51,70
Total income	57,470	53,91

DAYTON POWER & LIGHT COMPANY.

	June, 1918.	1917.	6 months ended June 30, 1918.	1917.	12 months ended June 30, 1918.	1917.
Gross earnings	$173,606	$125,182	$1,121,327	$898,391	$2,103,554	$1,742,00
Operating expenses (including depreciation and taxes)	117,294	84,400	794,612	610,595	1,450,562	1,200,11
Net earnings	$ 56,312	$ 40,782	$ 326,715	$287,796	$ 652,992	$ 541,94
Non-operating revenue	3,769	632	14,404	4,257	20,481	7,93
Total income	$ 60,081	$ 41,414	$ 341,119	$292,053	$ 673,473	$ 549,88
Interest on bonds	$ 32,192	$ 15,121	$ 160,360	$ 90,895	$ 251,085	$ 182,12
Other deductions (includes other interest and sinking fund)	11,424	10,118	70,504	61,536	133,326	97,44
Total deductions	$ 43,616	$ 25,239	$ 230,864	$152,431	$ 384,411	$ 279,56
Net income	$ 16,465	$ 16,175	$ 110,255	$139,622	$ 289,062	$ 270,31
Dividends on preferred stock	14,813	14,813	88,875	88,875	177,750	177,75
Surplus	$ 1,652	$ 1,362	$ 21,380	$ 50,747	$ 111,312	$ 92,56

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid Aug. 20.	Bid Aug. 27.
Adirondack Electric Power of Glens Falls, common	6	13	13
Adirondack Electric Power of Glens Falls, preferred	6	68	68
American Gas & Electric of New York, common	10+extra	81	81
American Gas & Electric of New York, preferred	6	37	37
American Light & Traction of New York, common	..	185	184
American Light & Traction of New York, preferred	6	91	91
American Power & Light of New York, common	4	40	40
American oPwer & Light of New York, preferred	6	66	66
American Public Utilities of Grand Rapids, common	..	..	..
American Public Utilities of Grand Rapids, preferred	6	..	..
American Telephone & Telegraph of New York	..	96	98½
American Water Works & Elec. of New York, common	..	4⅜	4½
American Water Works & Elec. of New York, particip	7	12	12
American Water Works & Elec. of New York, first preferred	..	57	57
Appalachian Power, common	..	3	3
Appalachian Power, preferred	7	21	21
Cities Service of New York, common	+extra	210	209
Cities Service of New York, preferred	6	74½	72½
Commonwealth Edison of Chicago	8	100	103
Comm. Power, Railway & Light of Jackson, common	..	22	22
Comm. Power, Railway & Light of Jackson, preferred	6	41	42
Federal Light & Traction of New York, common	..	7	7
Federal Light & Traction of New York, preferred	..	35	35
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	17	17
Middle West Utilities of Chicago, preferred	6	37	37
Northern States Power of Chicago, common	..	44¾	43
Northern States Power of Chicago, preferred	ex.div.7	79	80
Pacific Gas & Electric of San Francisco, common	..	35	34
Pacific Gas & Electric of San Francisco, preferred	6	79	79¼
Public Service of Northern Illinois, Chicago, common	7	72	73
Public Service of Northern Illinois, Chicago, preferred	6	95	97
Republic Railway & Light of Youngstown, common	4	28	29
Republic Railway & Light of Youngstown, preferred	6	57½	57
Standard Gas & Electric of Chicago, common	..	4½	4⅝
Standard Gas & Electric of Chicago, preferred	6	23	23
Tennessee Railway, Light & Power of Chattanooga, common	..	2¾	3⅛
Tennessee Railway, Light & Power of Chattanooga, preferred	6	14	15
United Light & Railways of Grand Rapids, common	4	29	29
United Light & Railways of Grand Rapids, preferred	6	61	61½
Western Power of San Francisco, common	..	12	12
Western Power of San Francisco, preferred	6	49¼	49
Western Union Telegraph of New York	extra	90	85
Industrials—			
Electric Storage of Philadelphia, common	4	54	52
General Electric of Schenectady	8	146	146
Westinghouse Electric & Mfg. of Pittsburgh, common	7	43	43½
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	58	61

*Last sale.